ELECTRICAL TIMES

A NEW SYMBOL FOR POWER...

AEI **CABLE DIVISION**

Associated Electrical Industries Ltd.

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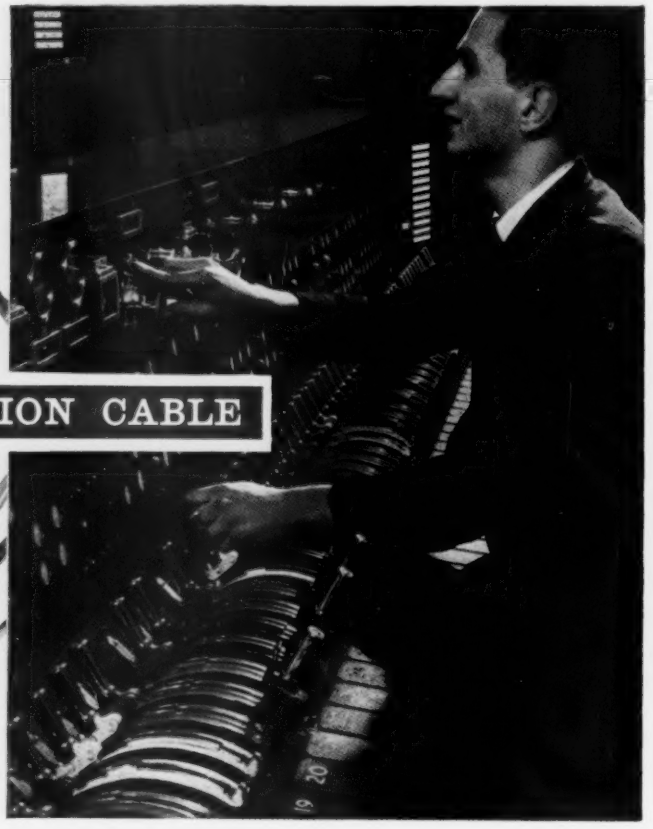
Photograph by courtesy of British Railways



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Efficient traffic operation and safety of passengers, personnel and merchandise depend on completely reliable signalling and telephonic communication. The most exacting requirements of the railway industry's modernization plans are met by a complete range of Hackbridge Plastic Sheathed Communication Cables which offer a robust, yet flexible, cable which will not support combustion.

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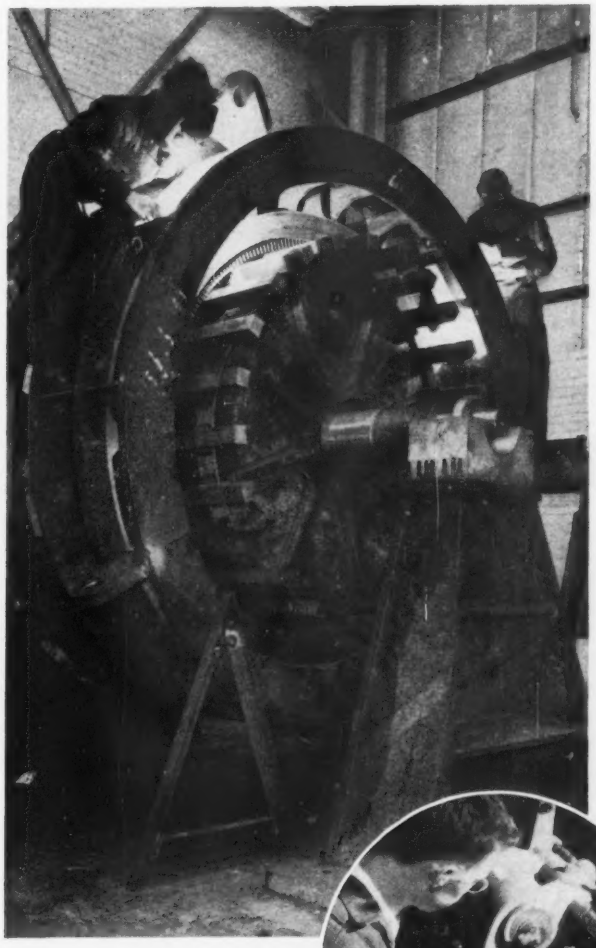

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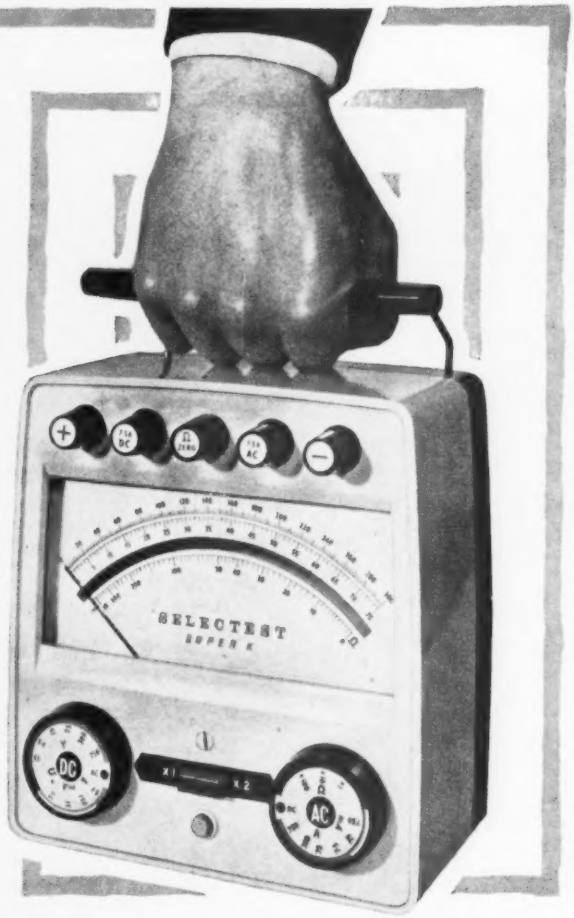

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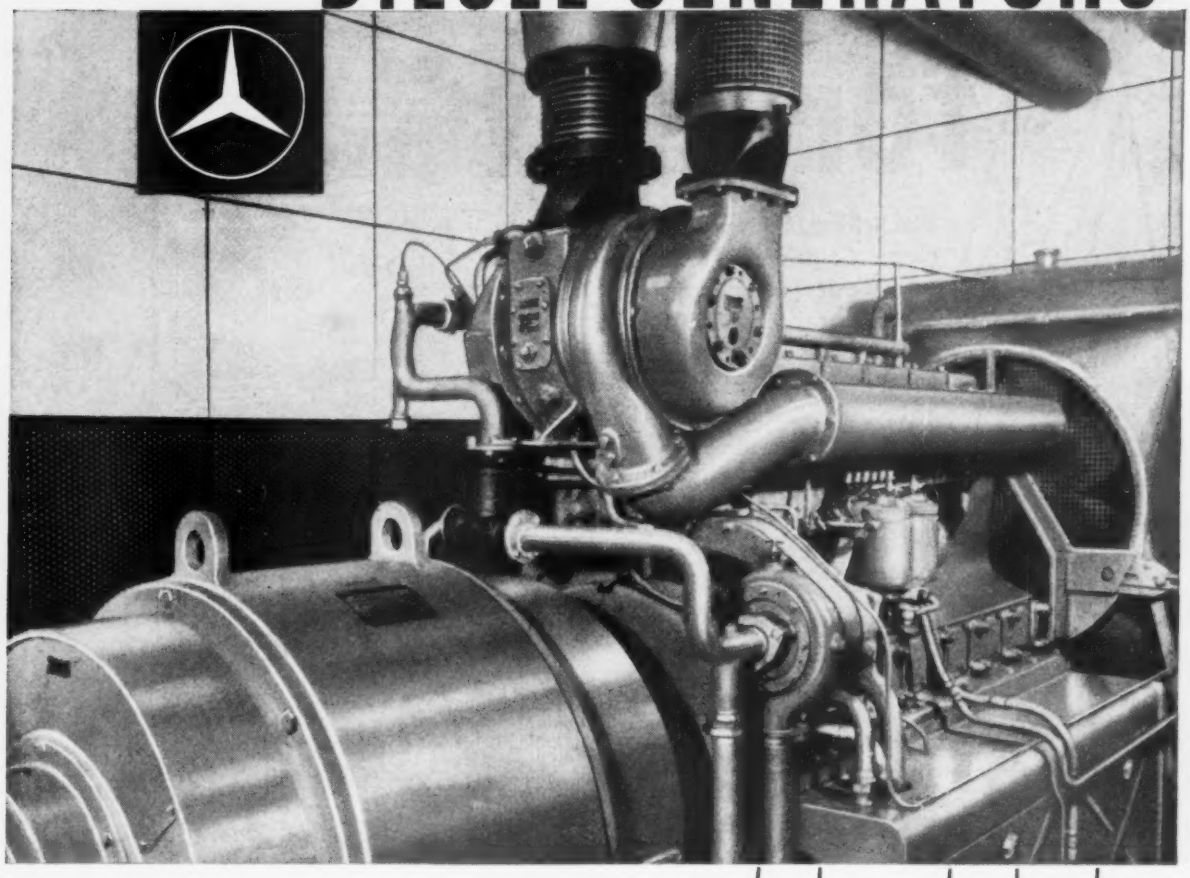
DIESEL GENERATORS



The Mercedes-Benz Diesel Generator is today's most efficient, easily maintained and economical source of electrical power in its field. The very name guarantees its dependability. Ranging from 2 to 12 cylinders, these generating sets are light and compact, keeping vibration to a minimum. Ideal for locations where the foundation is not excessively strong.

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42 57	M 203 B	3	750 1000	2300
57 76	M 204 B	4	750 1000	2500
12.5 24	OM 636	4	1500 3000	650
36 43	OM 312 OM 321	6 6	1500 1500	1000 1200
78 96	OM 315 OM 326	6 6	1500 1500	1800 2000
127 182	MB 846 A	6	1000 1500	4000
167 235	MB 846 Ab	6	1000 1500	4200
190 260	MB 836 B	6	1000 1500	5300
250 360	MB 836 Bb	6	1000 1500	5500
305 470	MB 836 Db	6	1000 1500	5800
380 525	MB 820 B	12	1000 1500	8000
520 735	MB 820 Bb	12	1000 1500	9000
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THE TEN TOP FEATURES OF THE BELLING 48T
• Eye-level controls.
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AND FOR YOU TOO!

NO ASSEMBLY NEEDED

Delivered complete with control panel already fitted and wired—no need for you to do any assembly work.

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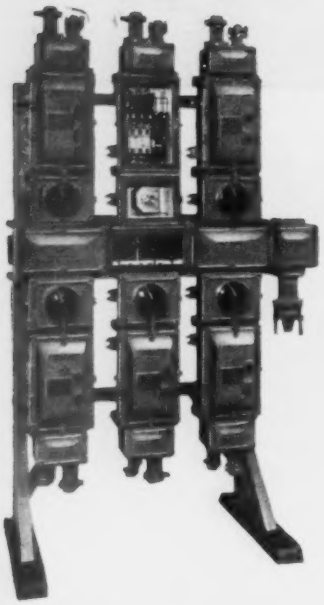
FLAMEPROOF EQUIPMENT
GROUPS I, II, III



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The illustrations below show some ancillary units available.

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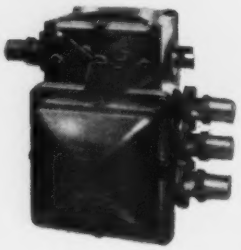
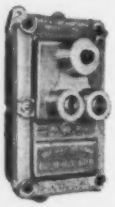


Flameproof Transformer Type BLT-14



Flameproof Push Button Type P.2 with lamp indicator

Flameproof Limit Switch Type LM.1

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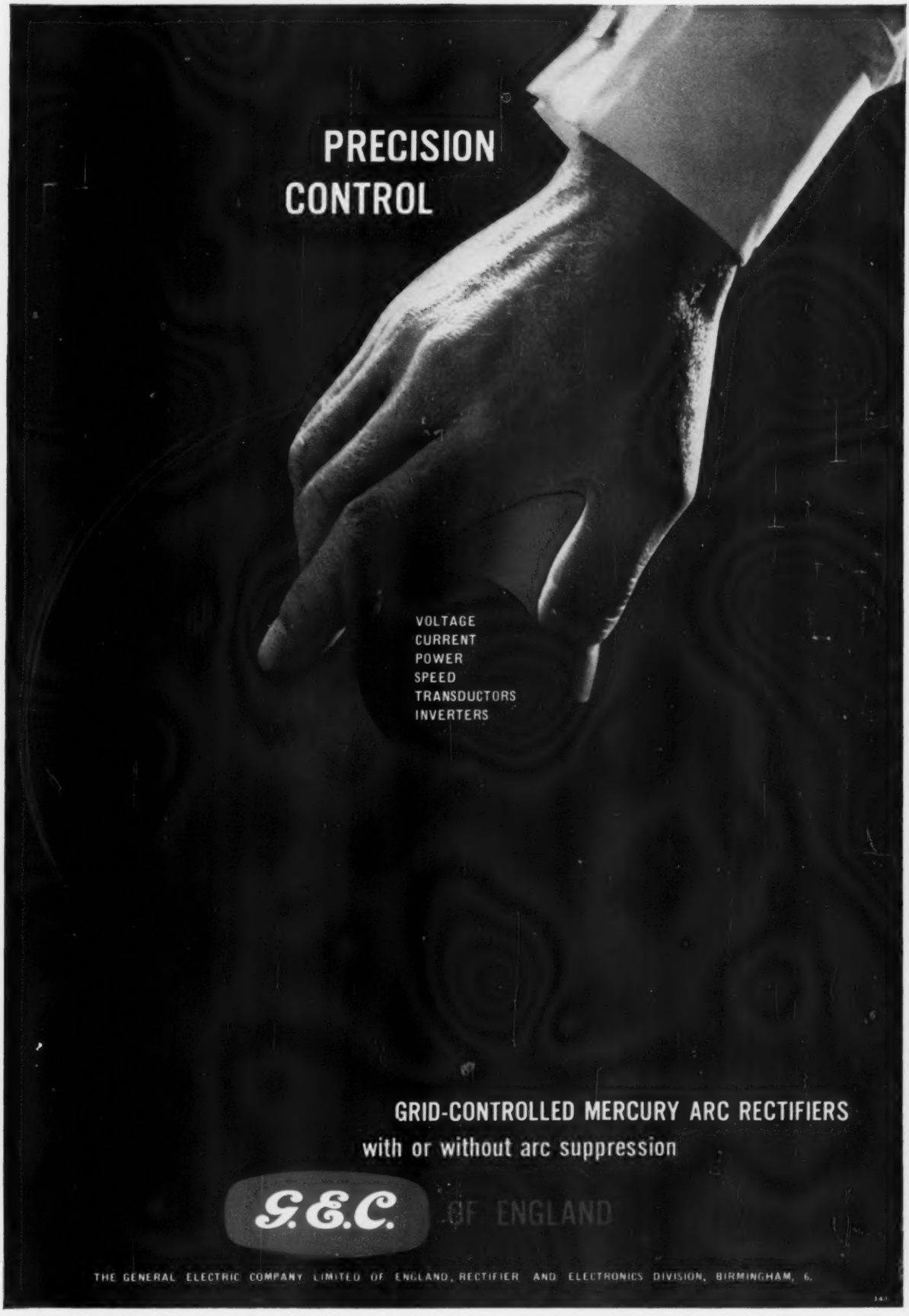
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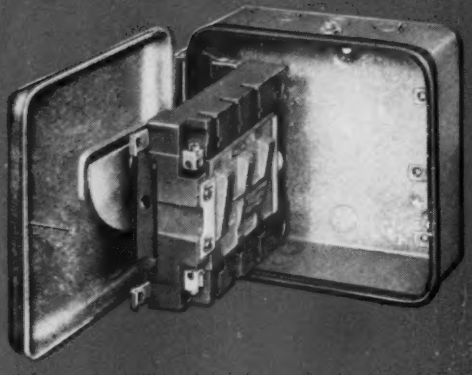

Star Switchfuse with cover open showing interior hinged forward for ease of wiring

Simplex Star

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The Simplex Star range — a low priced, high quality range of switchfuses, distribution boards busbar chambers, and switchboard assemblies.

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- ★ HRC or rewireable fuses.
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- ★ Unique ease of wiring facilities.

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- ★ Dead-front — all live parts fully shrouded even with fuses removed.
- ★ HRC or rewireable fuses.
- ★ Rewireable fuses (patents pending) complying fully with B.S.3036 1958.
- ★ Unique ease of wiring facilities.
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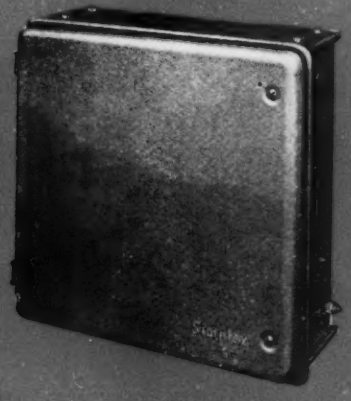
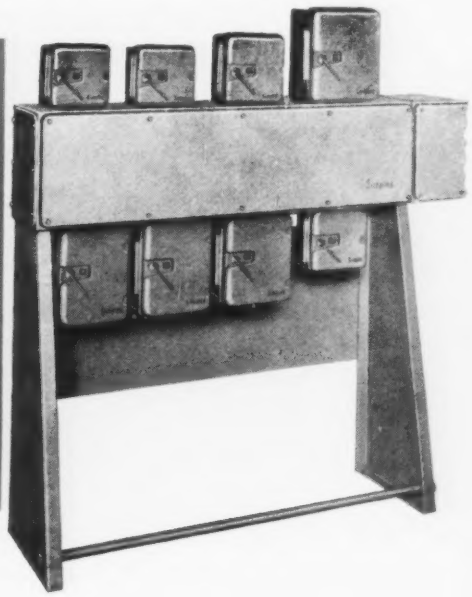
- ★ Fully gasketed.
- ★ Switchboard stand assemblies.
- ★ Switchboards available with Simplex S & S automatic control gear, fused switches, isolators, etc.



Star Distribution Fuseboard

Star Switchboard — a team of Simplex practical experts will help you with designing, building, and advice on complete Simplex switchboard installations



Send for the Simplex Star switchgear catalogue if you haven't already received one.

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special "thin-flash" type for grille moulding

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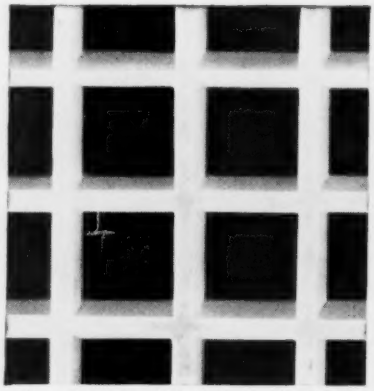

Heat resistance, dimensional stability, strength and electrical insulation properties are among the features making D.M.C. the ideal material for this grille. Moulding by Crystalate (Mouldings) Ltd, Tonbridge, Kent.

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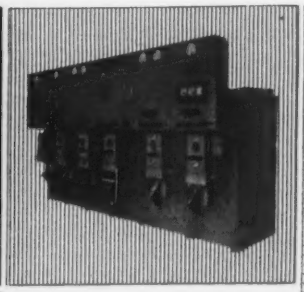
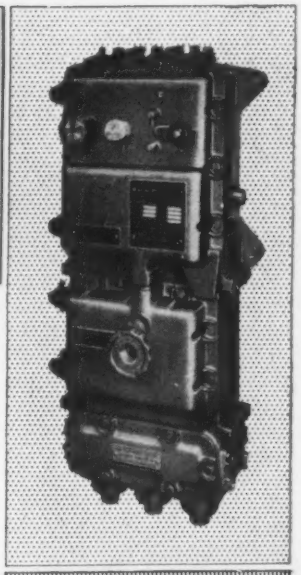
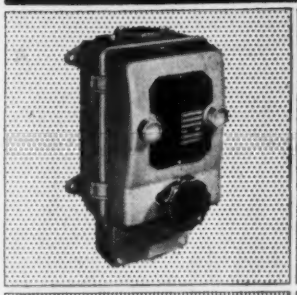
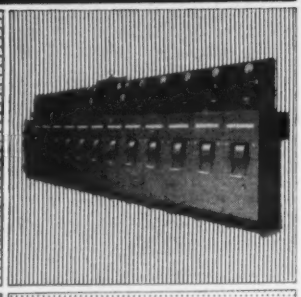
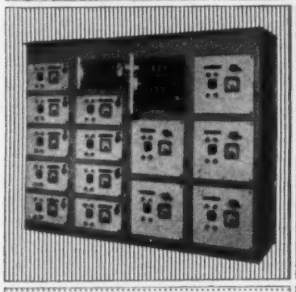


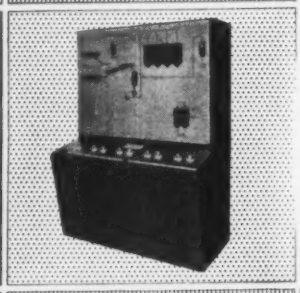


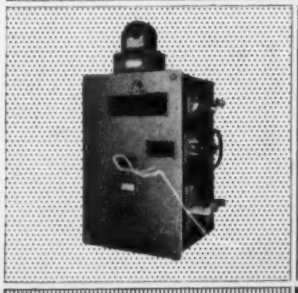


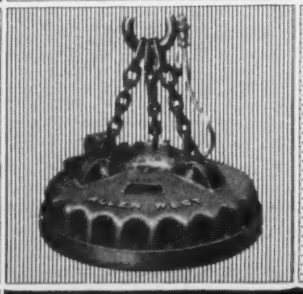


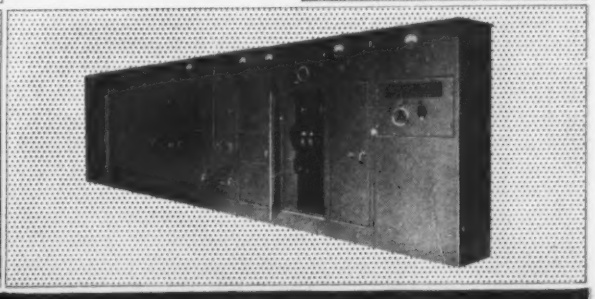
Electric Motor Control Gear

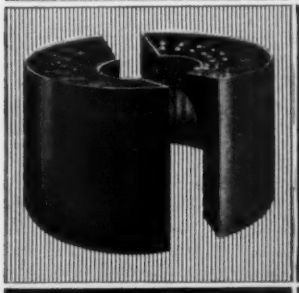












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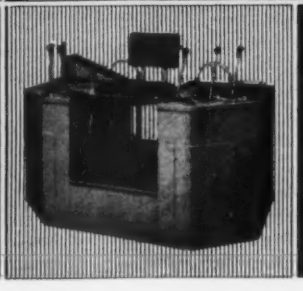

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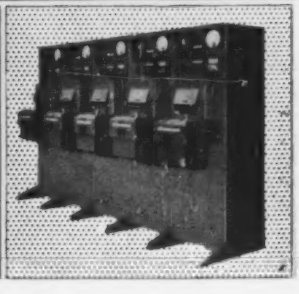

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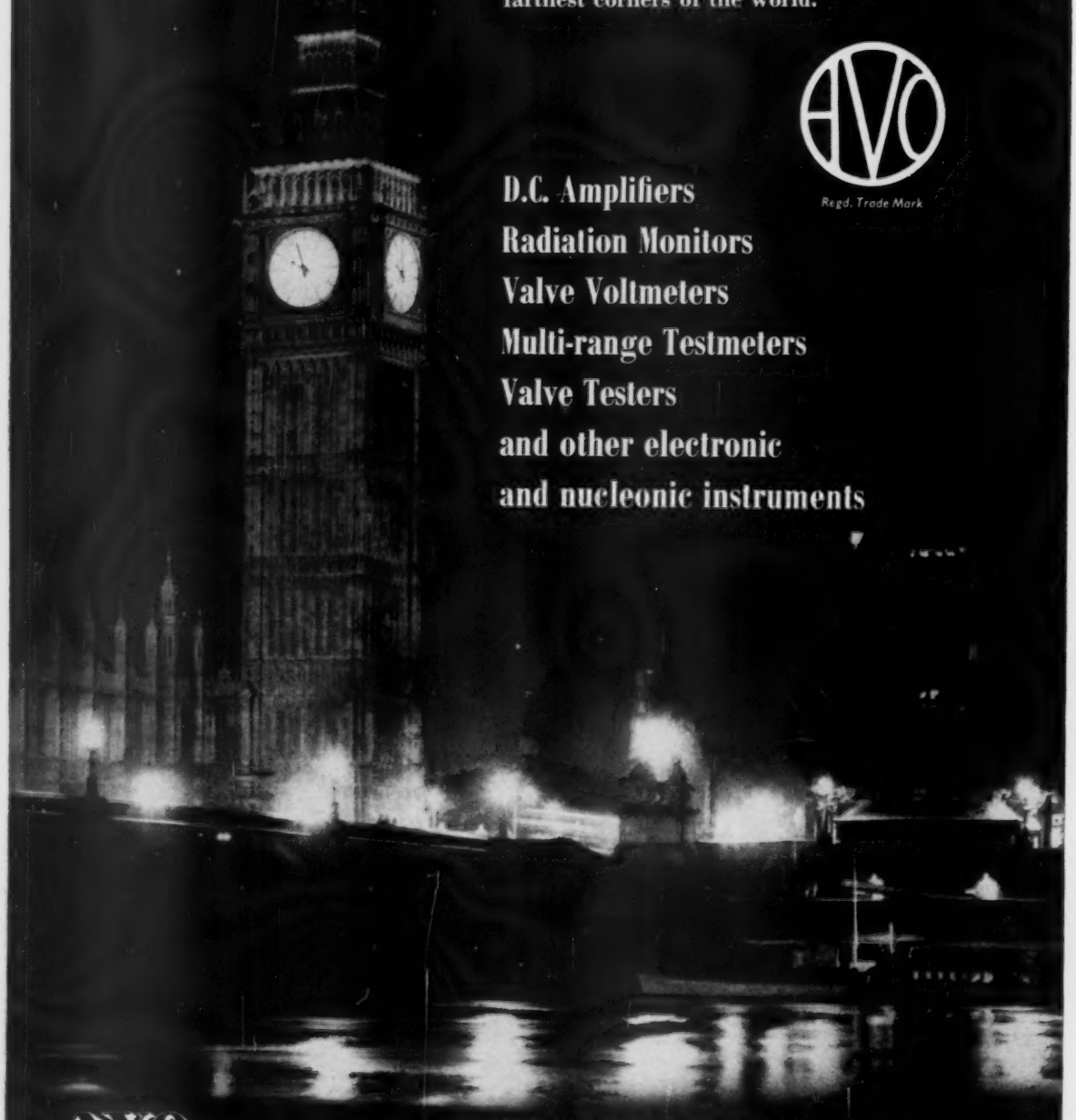

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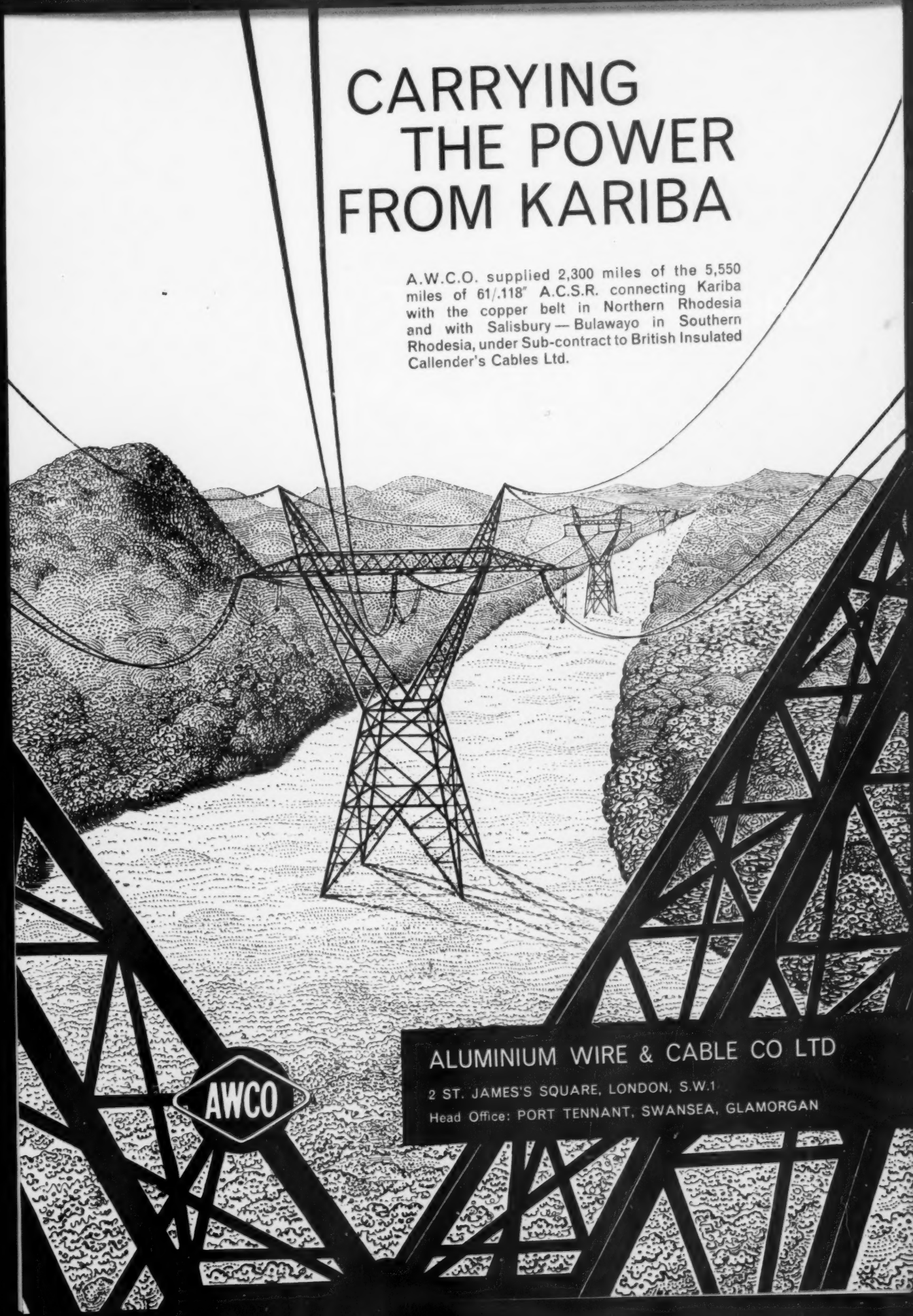

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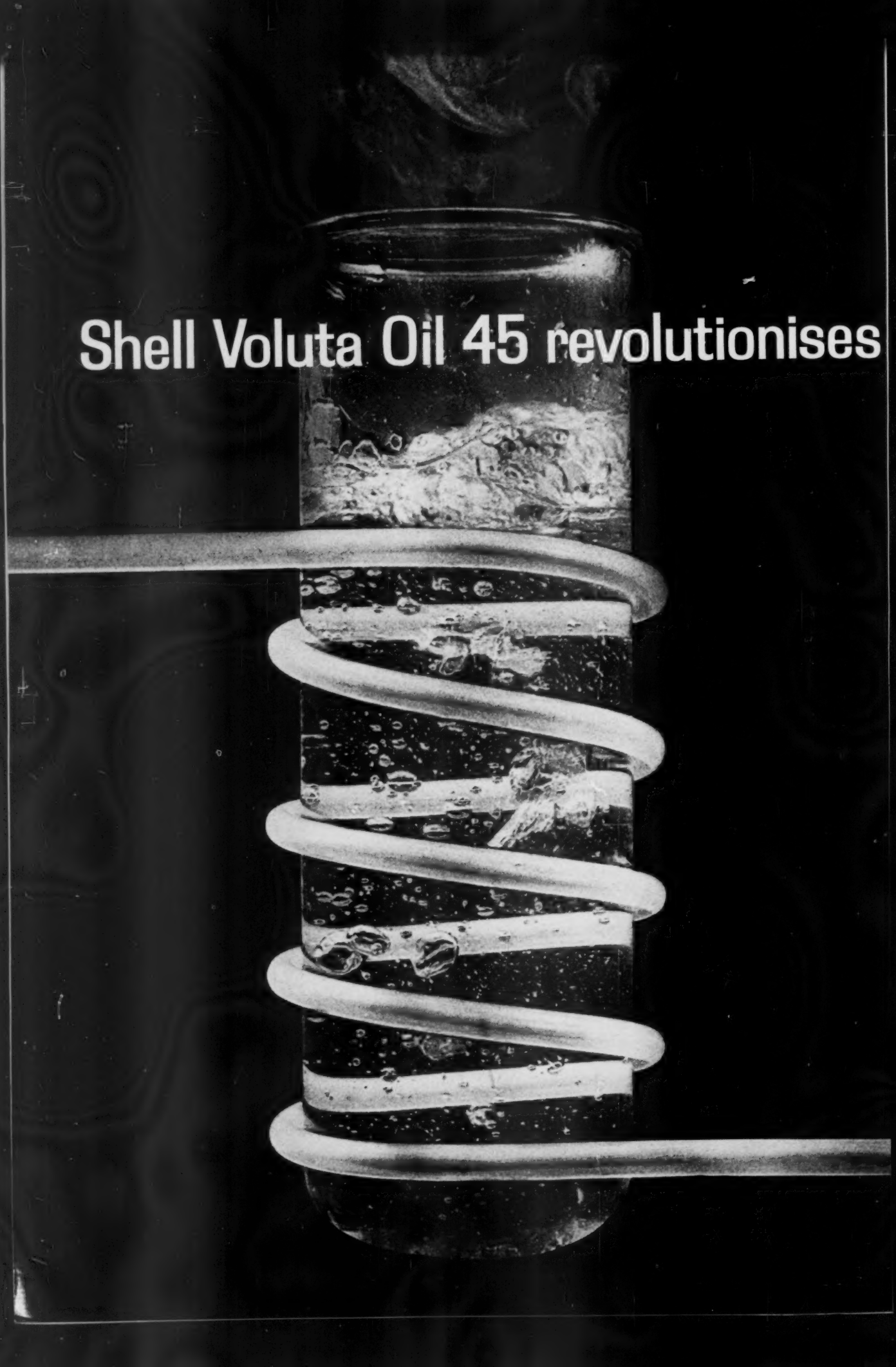

Shell Voluta Oil 45 revolutionises

heat exchange practice

Before Shell produced Voluta Oil 45 it was thought that oils which were to be used for heat exchange purposes must have a high flashpoint —to reduce fire risk, and a high viscosity—to prevent excessive leakage through pump glands and to provide adequate lubrication for pump bearings at high temperatures. Heat exchange systems containing these viscous oils, however, were sluggish, particularly when started up from cold. The oil circulated slowly over the source of heat and suffered thermal decomposition, or "cracking". This, in turn, produced low flashpoint materials and carbon which insulated the heating surface.

Shell, therefore, began investigating the suitability of oils of lower viscosity and different chemical constitution. From this research was developed Shell Voluta 45.

Shell Voluta 45 contains hydrocarbons with a saturated ring structure which does not have the tendency that high viscosity straight chain paraffin hydrocarbons had—to break down at high temperatures. Because of its low viscosity Shell Voluta 45 heats up more quickly from cold and circulates more rapidly thus avoiding local overheating and thermal decomposition.

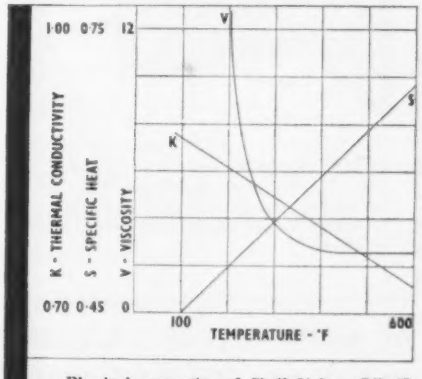
Shell Voluta Oil 45 has excellent heat transfer properties, good thermal stability and good lubricating properties. It is recommended for use in all closed heat transfer systems.

The moral of the story is that Shell research is supremely applicational. The centre at Thornton is always ready to work with even the most specialised sectors of industry to produce the right oil for the job. If you and your organisation have any major lubricating problems, it pays to get in touch with your local supplier of Shell Industrial Lubricants.

The Research Story

Laboratory research to compare the high temperature performance of various oils in a rig simulating practical conditions showed that when oils of varying viscosities were maintained at an average temperature of 325°C. for 200 hours, the closed flashpoint of the high viscosity oils had dropped to a lower figure than that of oils of lower viscosity, indicating that some thermal decomposition had taken place.

Experimental oils were subjected to Heat Stability Tests and to tests designed to measure the variation in heat transfer coefficient with time. The most promising of these oils was then given extensive field trials, both in Shell Installations and in industry. From this extensive research was developed Shell Voluta 45.



Physical properties of Shell Voluta Oil 45.
K. Thermal Conductivity—B.T.U./sq. ft. per hour per 1°F. per inch.
S. Specific Heat—B.T.U. per lb. per 1°F.
V. Viscosity—Kinematic centistokes.

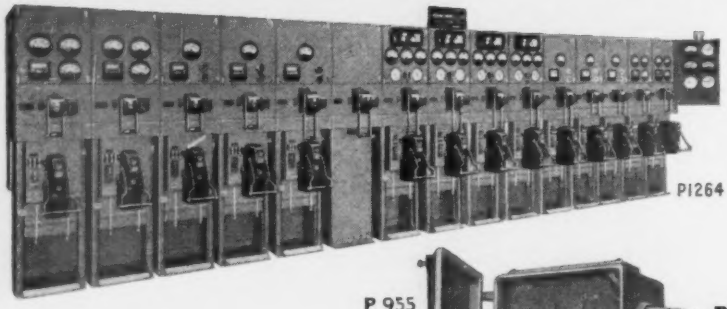
SHELL

HEAT TRANSFER OILS

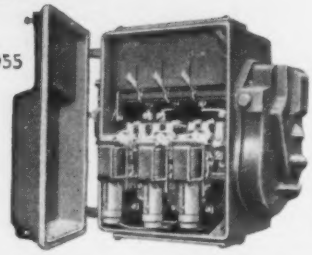
another proof of Shell leadership in lubrication

WE ARE SPECIALISTS IN SWITCHGEAR & MOTOR CONTROL GEAR

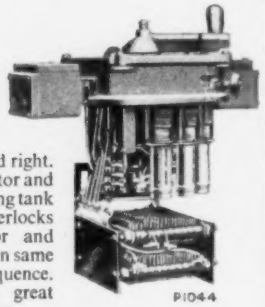
SWITCHBOARDS & HAND-OPERATED MOTOR CONTROL GEAR


P1264

P1264 Illustrated left, Switchboard recently supplied for controlling diesel Alternator Sets and Feeders at a large Sewage Works. This Switchboard is of the duplicate busbar type and contains circuit breakers ASTA certified at 25 MVA to BS. 116 at 400 volts.

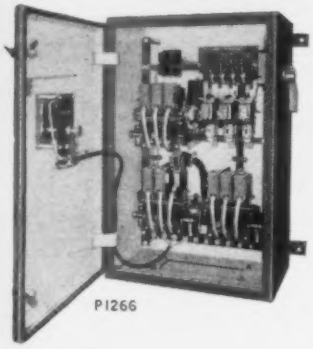

P. 955

P 955 Illustration on the right is of a hand-operated air break star delta starter, fitted with interlocked isolator and solenoid type overloads with time lags. This starter can also be supplied as a direct-on starter.

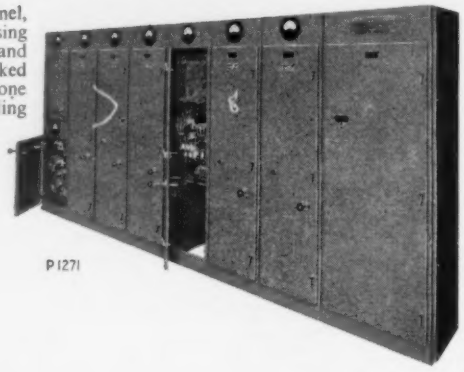

P1044

P1044 Illustrated right. Combined type stator and rotor starter showing tank removed. No interlocks required as stator and rotor contacts are on same drum in correct sequence. There is also a great saving in floor space.

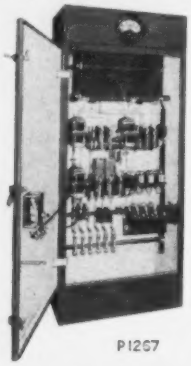
CONTACTOR TYPE SWITCHGEAR & MOTOR CONTROL GEAR


P1266

P1271 Illustrated right. Multi motor panel, contactor type Switchboard, comprising contactor type stator and rotor starters and star delta starters with fully interlocked isolating switches. This switchboard is one of many supplied to one of the leading Petroleum Companies.


P1271

P1266 Starter illustrated above is one of our CS. 30 pattern star delta starters, suitable for use up to 20 H.P. This type of starter is made in different ranges up to 250 H.P.


P1267

P1267 Starter illustrated at the left is a 50 H.P. CS. 75 type stator and rotor starter. This starter is made in different ranges up to 250 H.P. All our contactors above the CS. 15 size are bar mounted with powerful magnetic blowouts.

WE MANUFACTURE :- L.T. SWITCHGEAR 50/7,000 Amperes. E.H.T. SWITCHGEAR up to 11 kV. 250 MVA rupturing capacity. MOTOR CONTROL GEAR ¼/5000 H.P.

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SWITCHGEAR SPECIALISTS

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BROUGHTON, MANCHESTER (7)

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GRAND BUILDINGS, TRAFALGAR SQ., W.C.2

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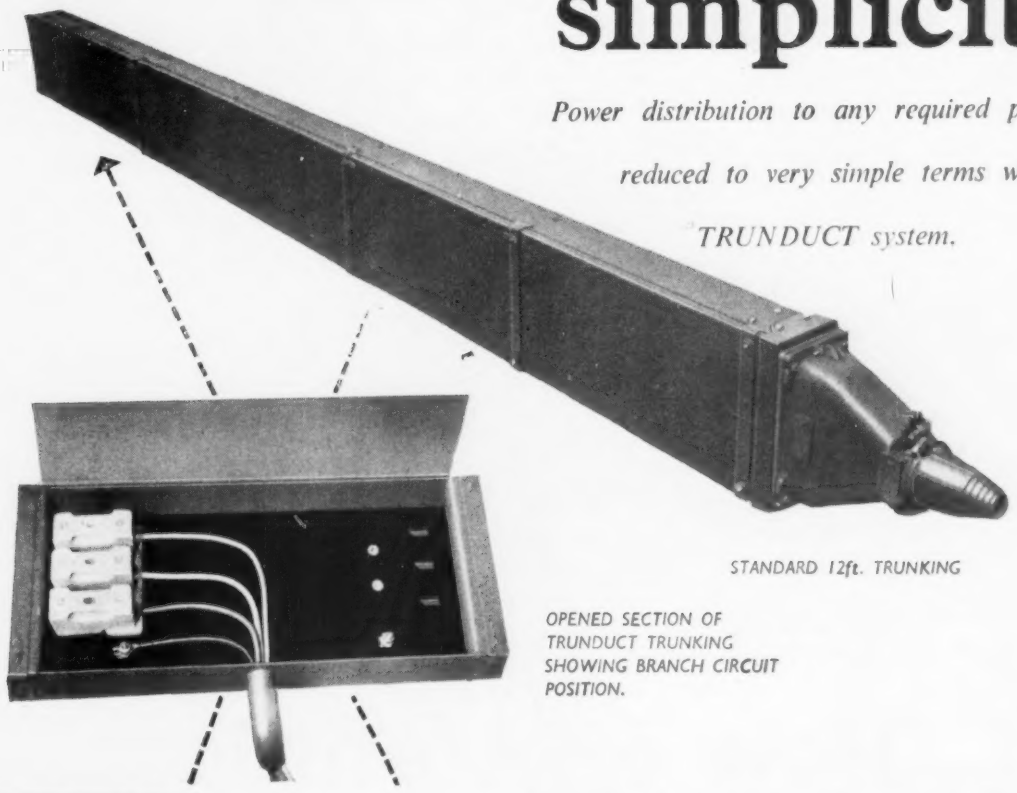
730

TRUNDUCT simplicity

Power distribution to any required point is reduced to very simple terms with the TRUNDUCT system.



STANDARD 12ft. TRUNKING

OPENED SECTION OF TRUNDUCT TRUNKING SHOWING BRANCH CIRCUIT POSITION.

TRUNDUCT ADVANTAGES IN LONG OR SHORT TERM PLANNING

Copper busbars used in a new economical manner are carried within standard lengths of steel ducting. Spaced along each length are four branch circuit positions which contain the necessary fuses plugged direct on to the main bus-bars. Tapping-off boxes are eliminated. This system provides much more efficient use of the bus-bars, cuts out potential sources of contact and earthing troubles normally associated with tapping-off boxes, provides easier methods of installation, saves time on planning, ordering and installation and offers the easiest possible way for balancing phases. In whatever way the system is installed it presents a clean streamline appearance.

You should investigate the **TRUNDUCT BUSBAR DISTRIBUTION SYSTEM**

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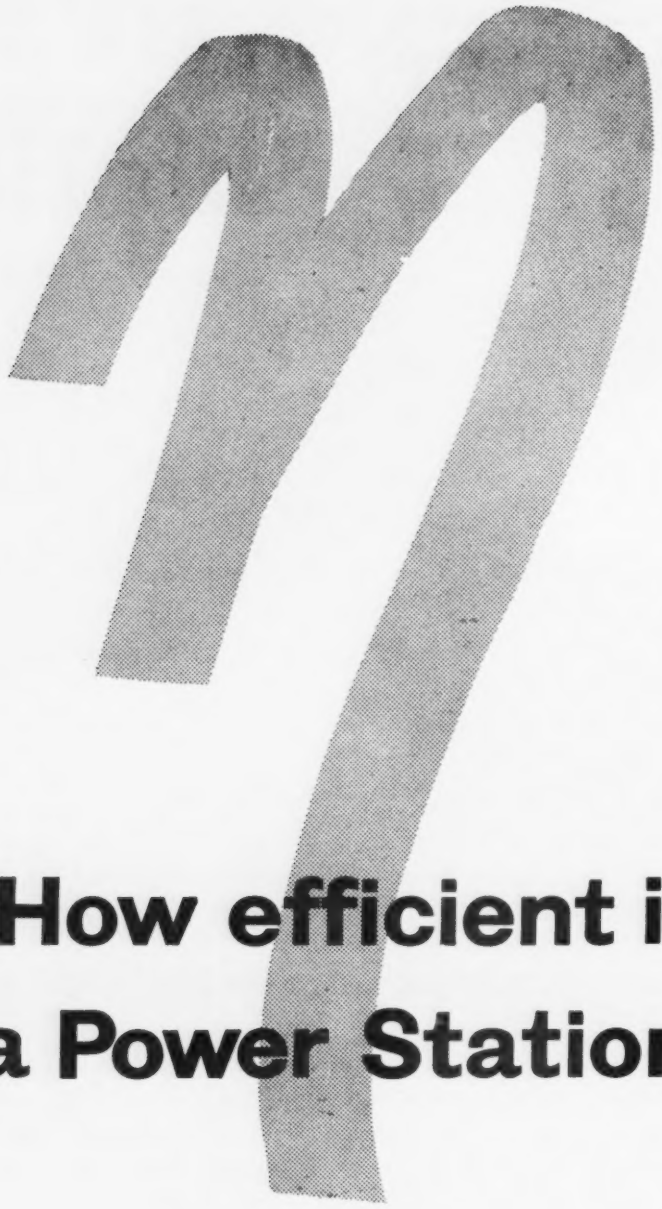

How efficient is a Power Station?

The term 'efficient' is often used loosely as an alternative to 'effective'. In Electricity Supply, however, the 'efficiency' of a power station has a well-defined and exact connotation. It indicates the heat energy expended to produce a unit of electricity.

Progressively, new power stations are more 'efficient' than their predecessors — they burn less coal for a given output. The engineers of the Central Electricity Generating Board are producing designs which, by increasing efficiency, enable power stations to offset substantially the rising costs of materials.

In spite of increased efficiency, however, the available supply of suitable coal cannot long keep pace with the demand for electricity, which doubles every decade. The gap that threatens in the not distant future will now be filled by the rapidly expanding nuclear power programme.

CEGB

THE CENTRAL ELECTRICITY GENERATING BOARD

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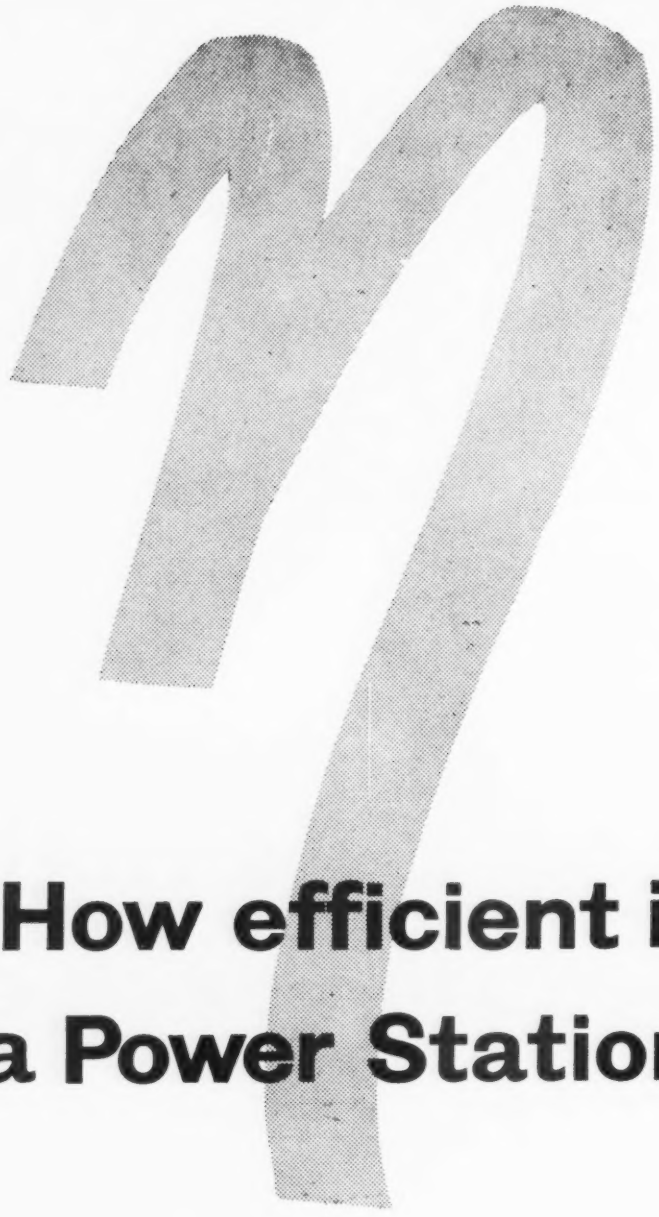

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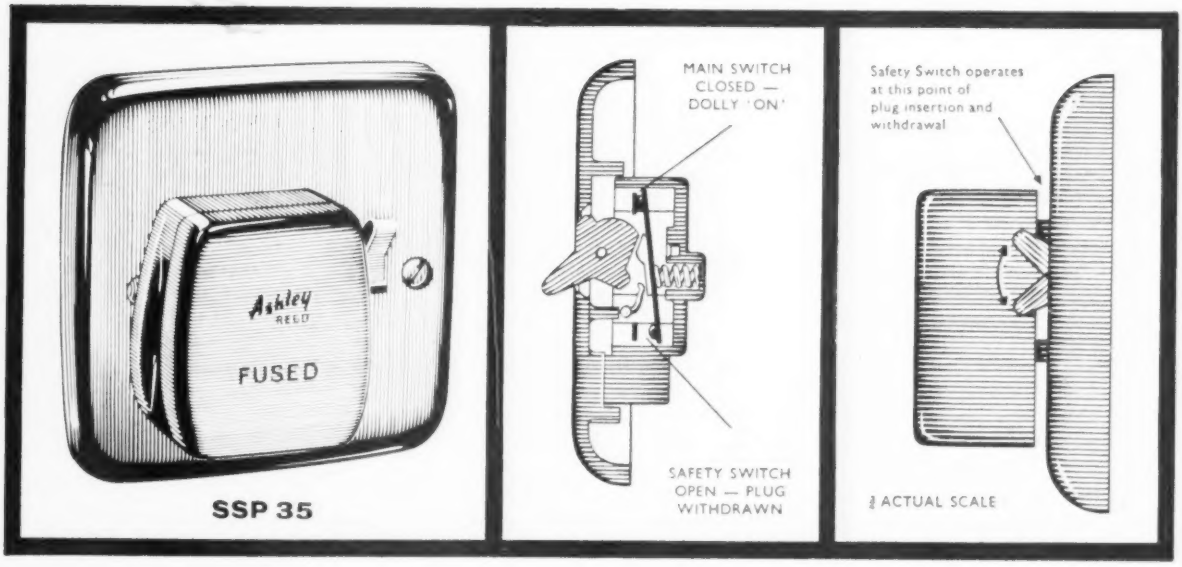

13 AMP SWITCHSOCKETS		
CAT No	DOZ LIST	TYPE
SS 31	69/-	Surface Br
SS 32	76/-	Surface Cr
SS 35	67/-	Flush Br
SS 36	74/-	Flush Cr
HEAVY DUTY		
SS 41	92/8	Surface Blk
SS 45	81/4	Flush Blk

13 AMP FUSED PLUGS		
PG 13	34/-	Brown
PG 14	38/-	Cream
HEAVY DUTY		
PG 15	49/-	Black

ASHLEY 13 AMP SWITCHSOCKET WITH SAFETY SWITCH

The 'Ashley' safety device effectively prevents fingers from touching "live" pins during plug insertion or withdrawal — the pins only being "live" when almost home.

OPERATION: Two switches are used in series in the Line circuit one (main switch) is controlled by the dolly; the other (safety switch) by the plug. Regardless of dolly position, the Safety Switch controls output during plug insertion or withdrawal. Both switches are fully rated.

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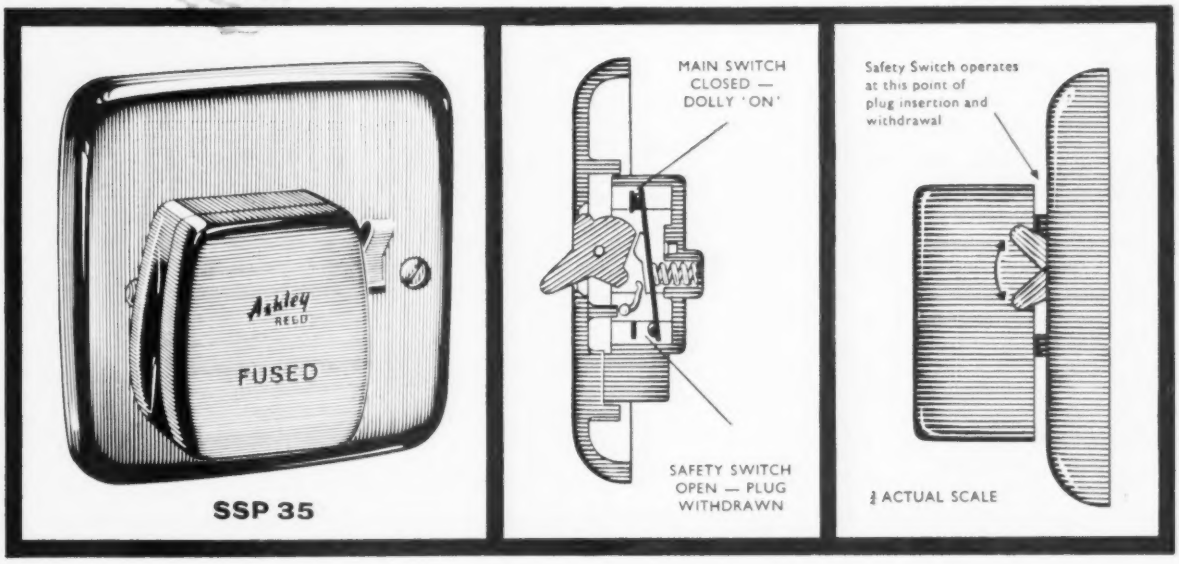

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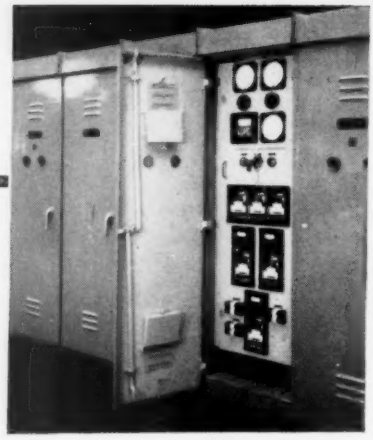
OUTDOOR SWITCHGEAR OF **UNIT** CONSTRUCTION

FOR VOLTAGES UP TO 15 kV

Switchgear for installation where it is neither practicable nor economically possible to build a covered Sub-station of weather-proof construction. Readily accessible on both sides for operation and maintenance.

Capable of extension for future requirements



Range. Current ratings 400 to 1,600 amps.
Voltage. 2.2.—15 kV.
MVA ratings from 100 MVA—500 MVA

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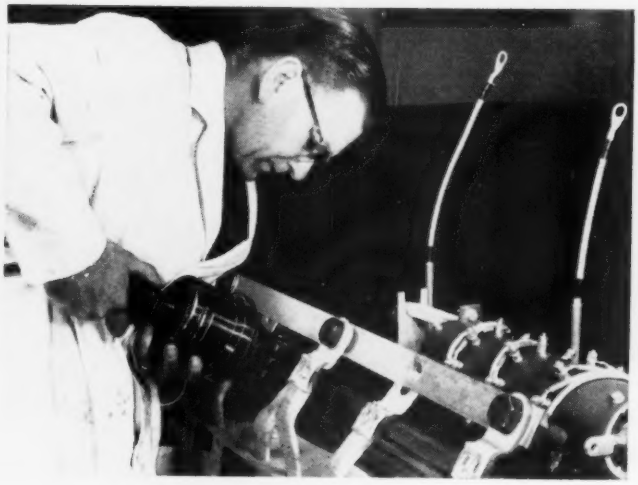
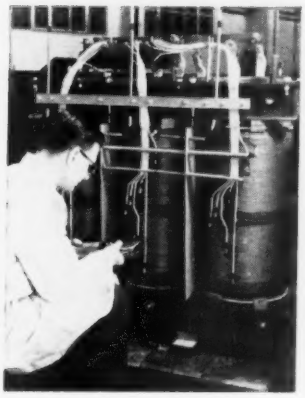
use *AMP solderless wiring devices

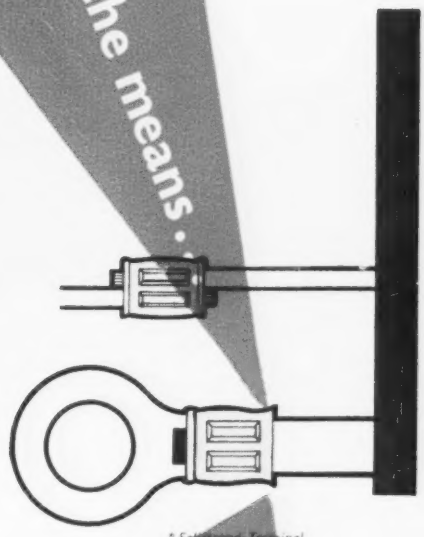




*Dyna-Crimp unit in use for application of M.C.M. range, *Solistrand Terminal to copper risers on Low Voltage side of T1 Specification Power Distribution Transformer.*

Pneumatic Hand Tool in use for Parallel Connection of Tap leads to Tap Changing Switch.

(Photographs by courtesy of Foster Transformers Ltd.)



* Solistrand Terminal

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▲ QUICKER APPLICATION
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▲ HIGH ELECTRICAL AND MECHANICAL STABILITY

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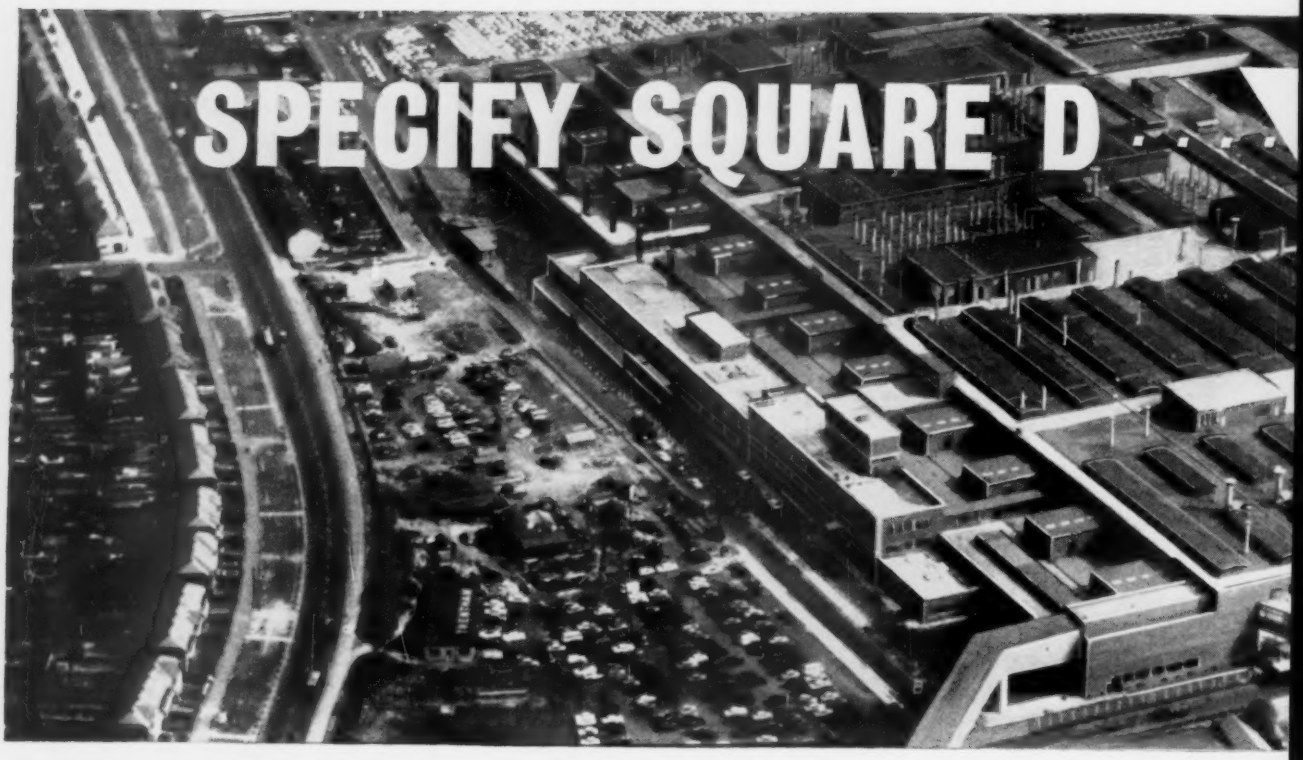
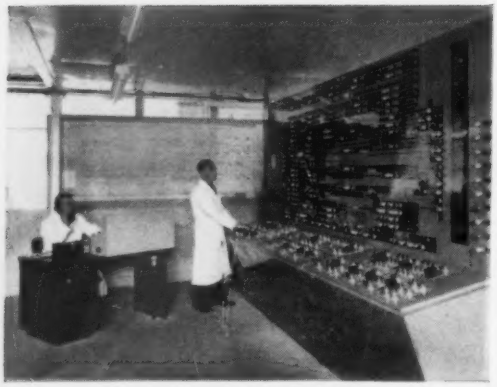
AP 130



FORD

£10 million 48 acre paint trim and assembly plant— **SQUARE D** gear controls vital 10 miles of flow line

Square D plays a key part in this new plant—the most advanced of its type to-day. Its selective conveyor system was designed and installed by Geo. W. King Ltd. in co-operation with Ford engineers.



One of the two control rooms which tracks and controls the movements of car bodies on the automatic transfer system through the paint shop. All breaks and changes in flow are registered and conveyor speeds regulated from this Square D panel.

Square D was specified for the plant's complex range of automatic flow line operations. Two central control rooms, together with several local consoles designed and built by Square D, supervise the entire handling system. Hundreds of Square D 2-unit push button stations and limit switches are heavily worked in this up-to-the-minute example of automation in the motor industry.

LEADERS IN CONTROL GEAR FOR OVER 50 YEARS

D

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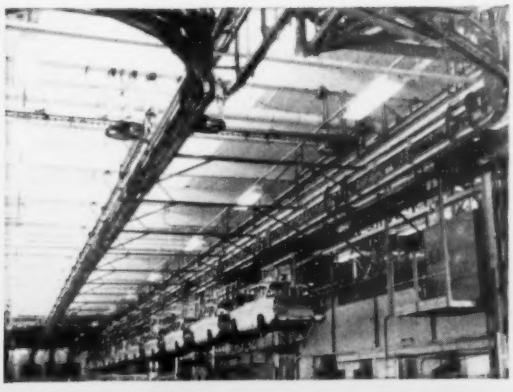
. . . . wherever electricity is controlled

Local consoles sited throughout the plant supplement the two central control rooms. Here the transfer between primer and final enamel sections is supervised.



The system of indexers regulates the flow of bodies over the conveyor bridge and into twin storage lines before the phosphating process. Each line of 11 bodies is fed alternately by automatic selection.

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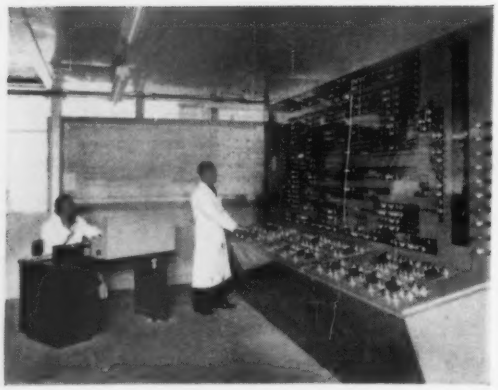

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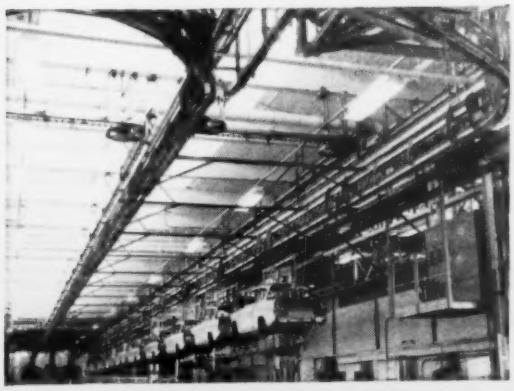

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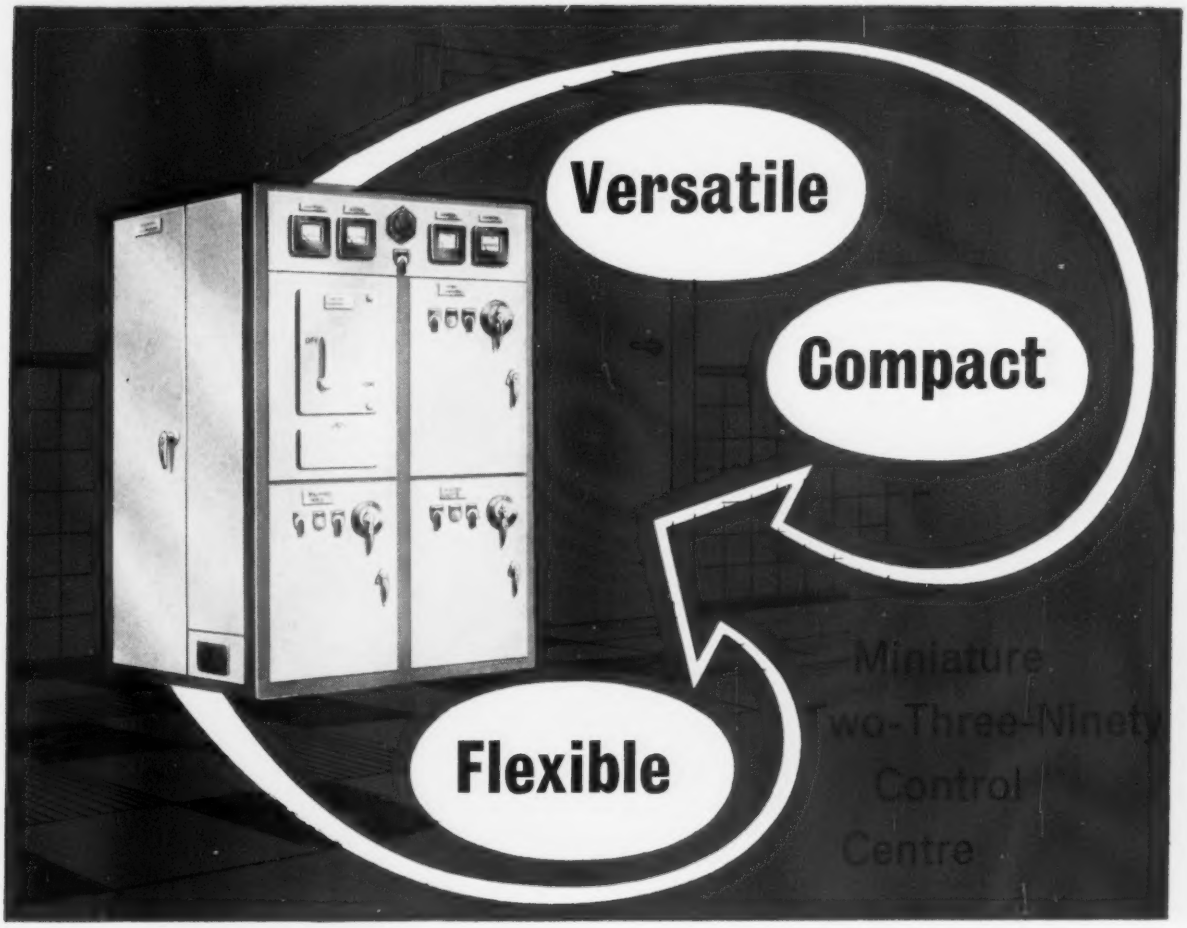

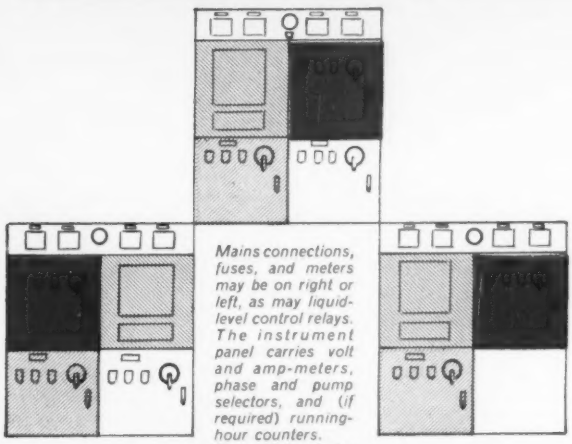

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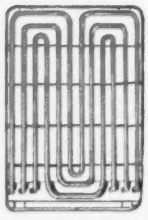
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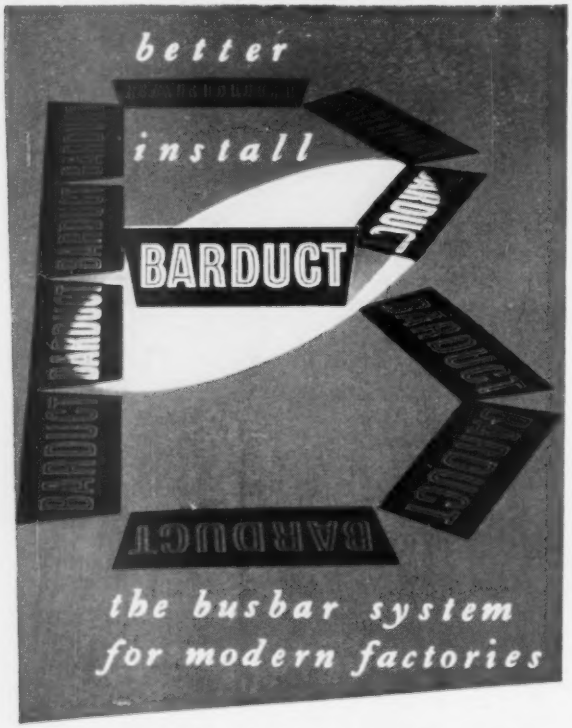

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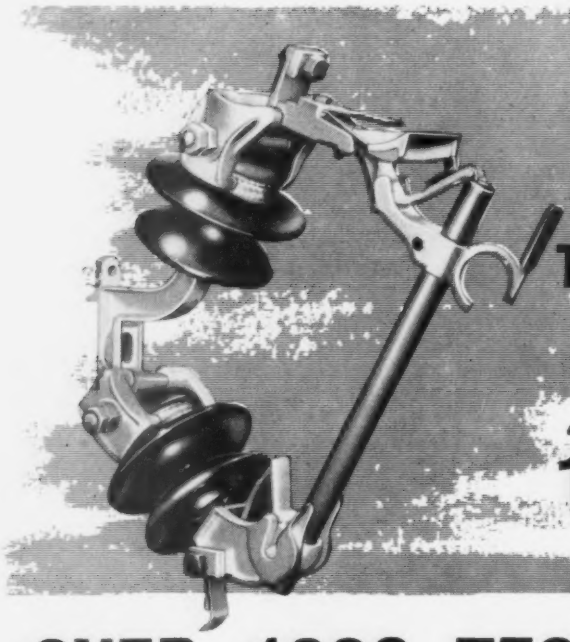

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15 amp round pin . . . **35/-**

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flat pin (fused) **37/6**

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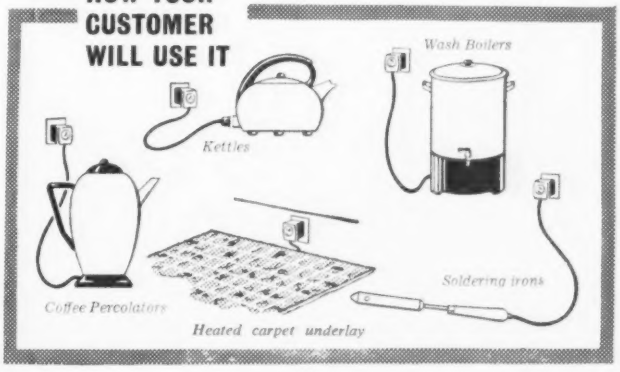

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AEI

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P.O. Box 1 Harlow Essex Harlow 25271
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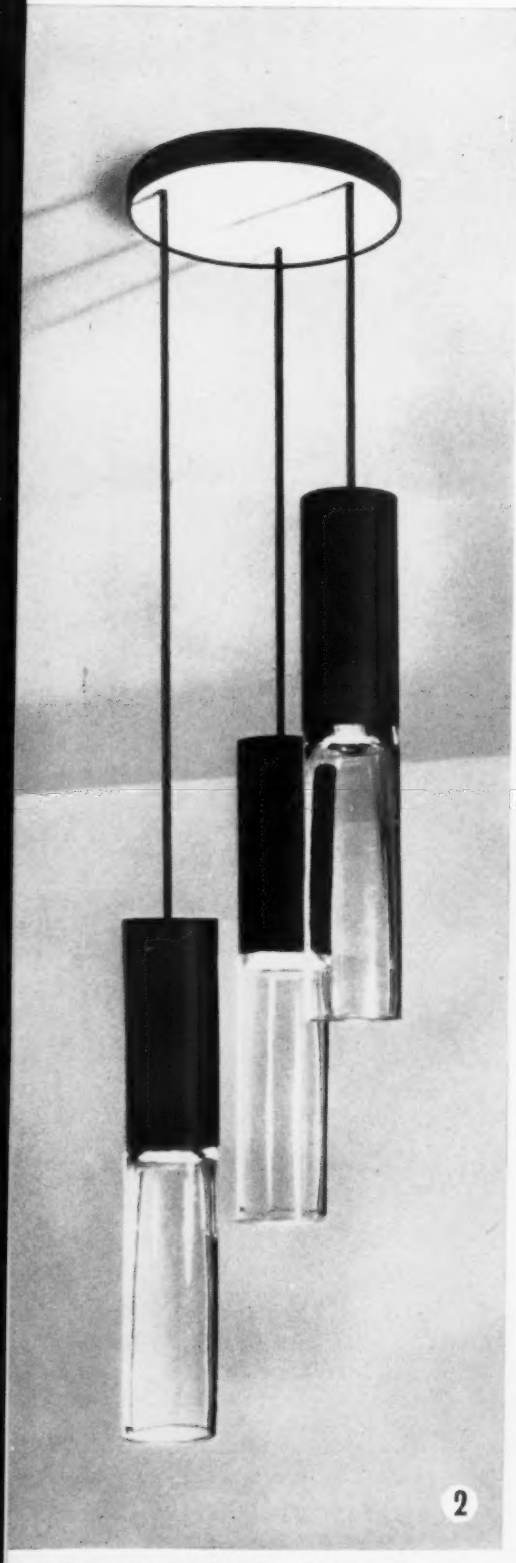
1

COUNCIL OF INDUSTRIAL DESIGN

3



All the lighting fittings which this year won Design Centre Awards from the Council of Industrial Design are Atlas products. In addition Atlas Lighting Limited now becomes the first company to win three of these coveted awards in the same year.

This highlights the success of the Atlas design policy, which first gained 'official' recognition when the Atlas 'Kitchenlight' won similar distinction.

1 *Street Lighting Lanterns and Columns. Models Gamma 4 and Gamma 5.*

2 *'Chelsea' handwrought glass lighting fitting G.3 with JY Glasses.*

3 *Low Voltage Display Lighting fitting DB.0050 with Transformer TR2338.*

ATLAS LIGHTING LIMITED
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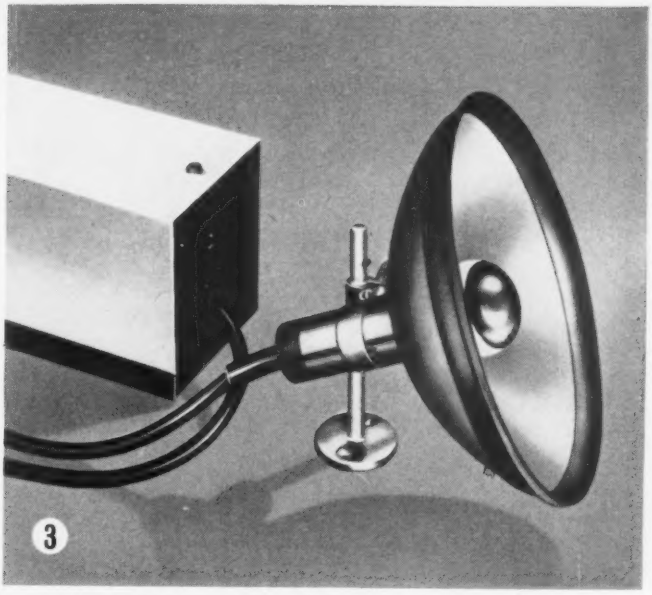
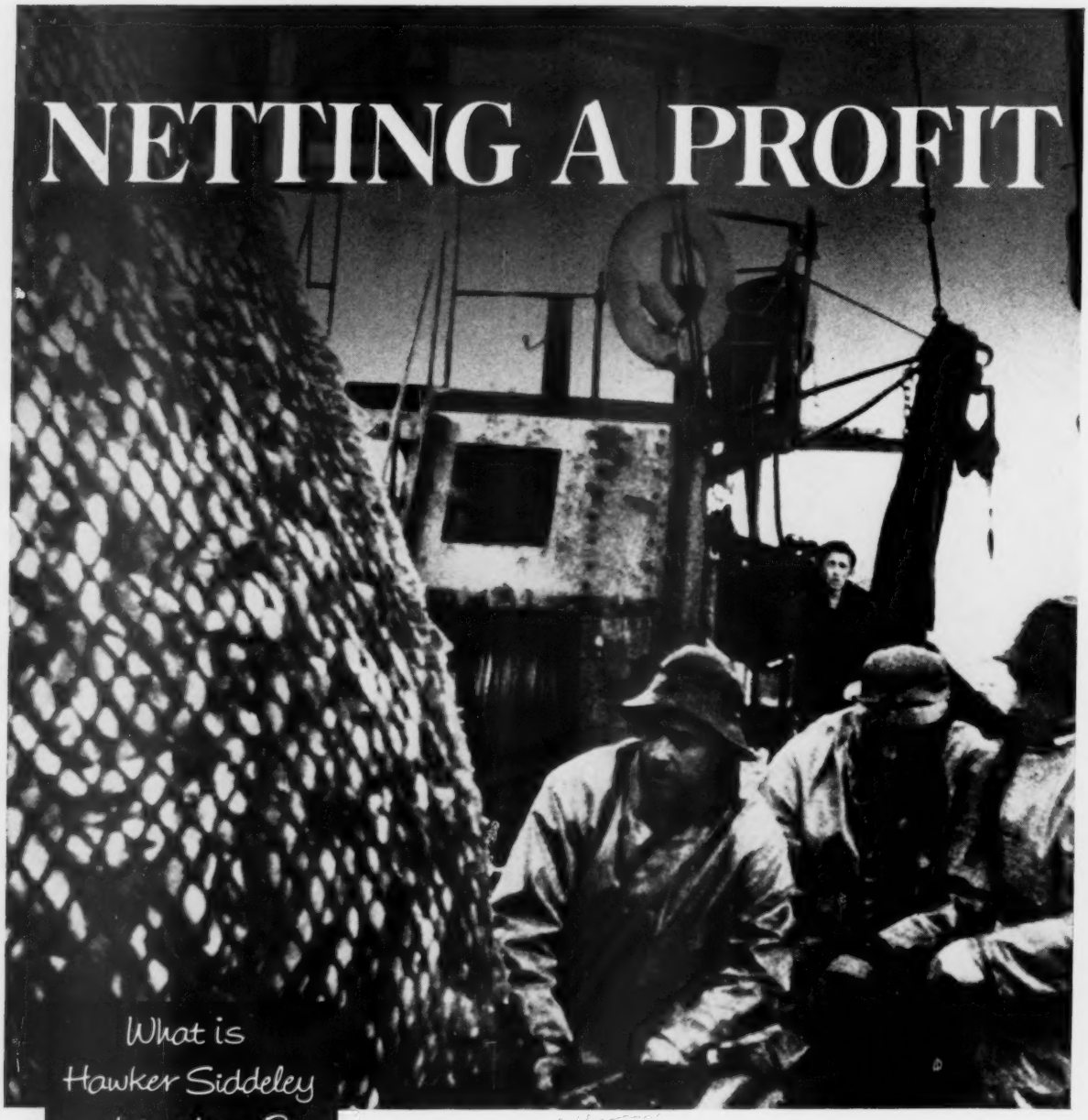
atlas



1960 DESIGN AWARDS FOR ATLAS LIGHTING LIMITED

DTV

NETTING A PROFIT



At dawn the trawler men check the harvest from the sea, the world's most bountiful farm. A hard-won harvest, yielding only to brave men and stout ships. Hawker Siddeley is here. The untiring diesels that take trawlers to sea are made by Mirrlees, one of the Hawker Siddeley group of companies. Mirrlees built the first diesel engine in Britain, one of the first in the world. Since then Mirrlees diesels have given power to trawlers, tankers, freighters, liners, tugs and battleships all over the world. To trains and trucks and tractors, too . . . for Hawker Siddeley Group is part of your life in many ways. Whenever you wonder " Who can do this ? " — tap the vast resources of the Hawker Siddeley Group. Call the Hawker Siddeley man in your part of the world. He speaks for one of the strongest industrial groups in the world.

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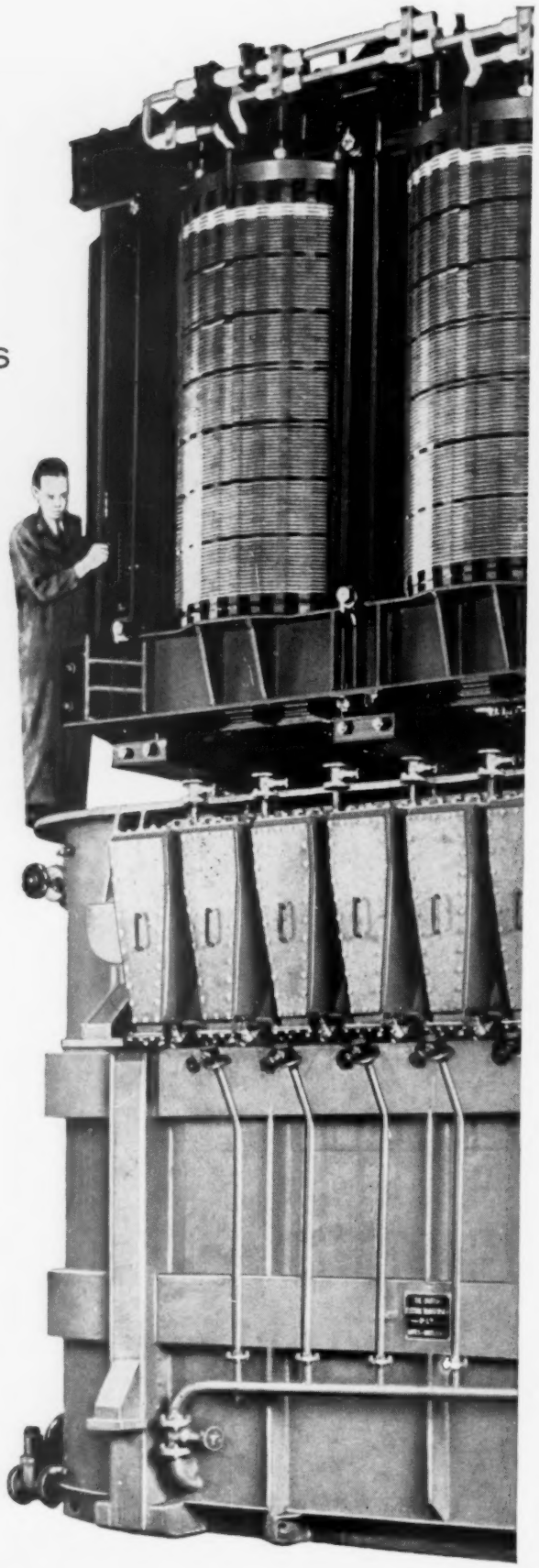
DESIGNING

AND MAKING TRANSFORMERS



You, as an engineer, know that there can be no sharp dividing line between designing and building. A good design incorporates experience gained in making, testing and installing similar equipment in the past. And, of course, it is also shaped by the experience of all sorts of people using the earlier designs under a variety of conditions that could not be simulated in any test laboratory.

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REGISTERED TRADE MARK

for
CATHODIC PROTECTION

in service at Fawley Oil Refinery

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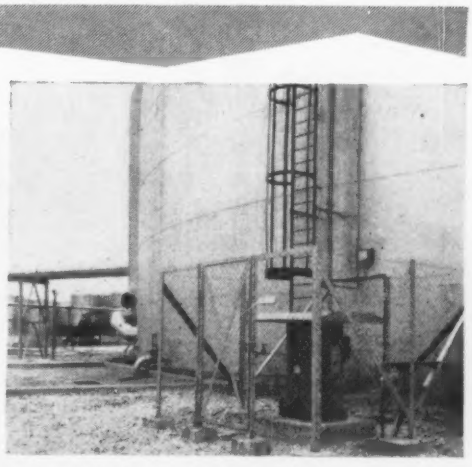
A Cathodic Corrosion Control Limited project.



SenTerCet Cathodic Protection Rectifier Equipments at Esso's Fawley Refinery

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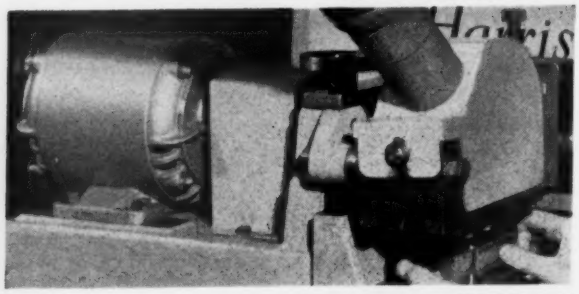

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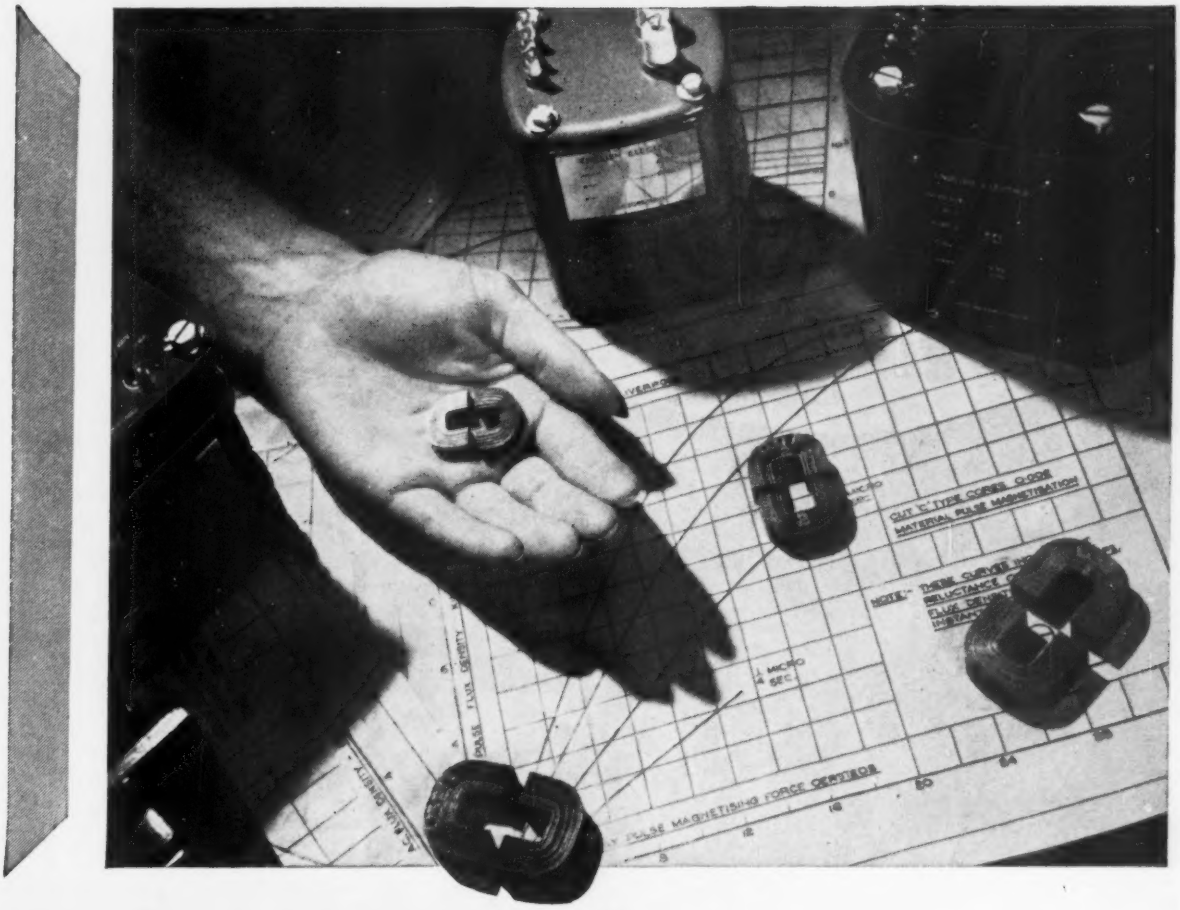

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Dans ce numéro

Etirage de tiges de cuivre à grande vitesse ... 791

Avec une barre de cuivre de 137 cm. de longueur et d'un poids de 120 kg., une nouvelle tréfilerie produit 400 m. de tige de 6,25 mm. de diamètre, à une vitesse de 1000 m./min. Des bottes de tige sont produites à des intervalles de 13 sec., dans un temps d'étirage total de 95 sec. Une force motrice électrique d'au total 6.000 CV est installée, avec une énergie maximum requise de 2.500 kVA. Aux stades de finissage de la tréfilerie, l'entraînement est assuré par des moteurs à courant continu alimentés à l'aide de redresseurs, la vitesse de ces moteurs étant contrôlée, soit en groupe, soit individuellement.

Exposition d'instruments, d'électronique et d'automation 797

Les appareils d'interprétation de données et les compatateurs applicables à de nombreux procédés industriels sont en évidence, cette année, parmi les 500 exposants, dont 100 viennent de pays en dehors du Royaume-Uni. Les appareils exposés comprennent des systèmes à trois dimensions pour la télévision et les microscopes, ainsi que l'application de dispositifs statiques et de circuits imprimés pour les appareils de commande, aussi bien qu'un assortiment d'instruments nucléaires de mesure.

Matériel utilisé dans des milieux corrosifs 809

Les produits chimiques corrosifs et le danger de concentrations explosives de gaz existent simultanément dans les usines le fabrication de produits au silicium. Une grande partie du matériel électrique est d'une conception à l'épreuve de la flamme, mais les appareils de chauffage qui ne peuvent être utilisés dans des enceintes ainsi protégées sont alimentés en azote inerte, à une pression de 0,14 à 0,21 kg./cm^2. Les locaux de commutation sont construits en briques et munis d'ouvertures du côté opposé aux zones de production. Ceci permet l'utilisation de matériel normalement enclos, sans la complication de constructions à l'épreuve de la flamme.

In dieser Nummer

Schnelles Auswalzen von Stangenkupfer 791

Aus Kupferbarren im Einzelgewicht von 120 kg mit einer Länge von 1370 mm werden auf einer neuen Schnellwalzstrasse je 400 m Stangenkupfer mit einem Durchmesser von 6,25 mm erzeugt, wobei die Walzgefertigen Rollen des Stangenmaterials das Walzwerk in Gesamtauswalzdauer von 95 Sekunden verlassen die fertigen Rollen des Stangenmaterials des Walzwerk in Zeitabständen von 13 Sekunden. Die hierfür aufgewendete Antriebsleistung beträgt 6 000 PS bei einem Spitzenstromverbrauch von 2 500 kVA. Richstromgespeiste Gleichstrommaschinen treiben die Fertigstrecken an, die sowohl gruppenweise wie auch einzeln regelbar sind.

Instrumenten-, elektronentechnische und Automationsgeräte-Ausstellung 797

Auf der diesjährigen Ausstellung nehmen Messgrössenverarbeitungs- und Rechengeräte einen grossen Raum ein. Von den 500 Ausstellern sind 100 ausländische Firmen. Ausgestellt sind u.A. Reliefsysteme für Fernsehapparate und Mikroskope sowie Beispiele für die Anwendung von Sperrschichtvorrichtungen und gedruckten Schaltungen bei Steuerungen und vielerlei kernphysikalischen Messgeräten.

Korrosions- und flammsichere Fabrikationsanlagen 809

In Werken, in denen Silikone erzeugt werden, hat man sowohl mit dem Vorhandensein ätzender Chemikalien wie mit der Gefahr explosiver Gaskonzentrationen zu rechnen. Ein grosser Teil der dabei verwendeten elektrischen Geräte ist sowieso flammsicher gebaut, aber Heizvorrichtungen z.B., deren Verwendung in flammsicheren Räumen nicht ohneweiteres zulässig ist, können mit Stickstoff unter einem Druck von 0,14—0,21 kg/cm^2 beschickt und Schaltkammern aus Backstein gebaut und mit Offnungen versehen werden, die benachbarten Erzeugungsanlagen abgewendet sind. Wenn solche Massnahmen, ergriffen werden, genügen normalabgeschlossene Einrichtungen und es erübrigt sich, diese in komplizierter und kostspieliger Weise flammischer zu machen.

From Bar to Rod in 95 seconds 791

New Thoughts on Lighting Levels 794

Instruments, Electronics and Automation Exhibition ... 797

400 kV in Sweden 806

INDUSTRIAL ELECTRICITY

Protecting A.C. Motor Circuits 807
by J. L. Watts, A.M.I.E.E.

Maintenance in Corrosive Conditions 809

Data Sheet 37 811

Background to Lighting Design 812

Surface Breakdown of Dielectrics 813

E.D.A. Responsibilities 822

Radioisotopes for Industry 822

FEATURES

Readers' Views 796
Notes on Wiring *by Megohm* 805
Overseas News 814
Personalities in the Industry 816
New Literature 818
Problems and Practice 819
Equipment for Industry 820
For the Electrical Trade 821
News of the Week 823
Company Activities 829
Commercial Information 830

News Sheet 21
Classified Advertisements 51
Index to Advertisers 58

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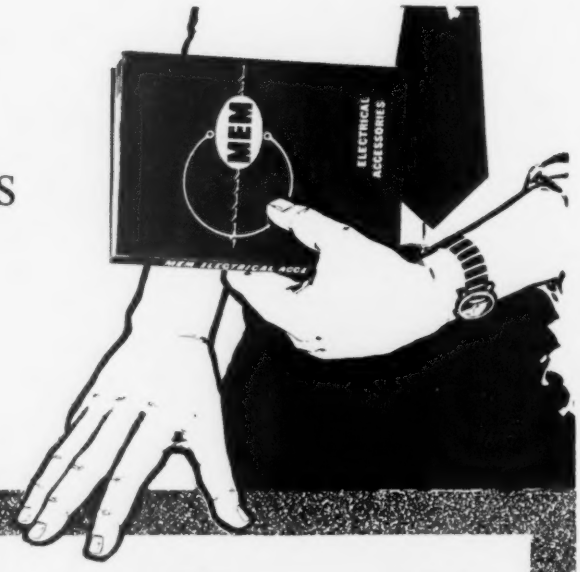

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ELECTRICAL TIMES

ESTABLISHED 1891

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Comment

LINKS FOR SIX AND SEVEN

For some time now, BEAMA has been providing a link between the domestic electrical appliance manufacturers of the European Common Market countries and those of the newer European Free Trade Association. That work was brought to an important stage last week when several members of the Seven were present at a meeting of the European Council of Domestic Electrical Equipment Manufacturers (of which the UK and Switzerland are already members). The hope is now that these members of the Seven will join the Six in this international trade association. The advantages must be many for everyone concerned. Even the apparently passive routine of expediting information on national developments of common interest is of real value, in the insurance it provides against new trade barriers growing up through technical or other regulatory steps by national Governments progressing to the point where representations are useless. By early information, interested overseas manufacturers are kept fully aware of what is happening, and may have time to influence events. But greater advantages than that can be hoped for from the extended CECED, and from other electrical organisations spanning the electrical industry of the two trading groups, and which should prove able to support one another in increasing effectiveness. BEAMA has common membership of the Seven and Six associations of metal industry trade associations, while it is not long since the EWF announced that it was joining the European Wholesalers' Federation. This new field of international co-operation is a development to be welcomed and fostered by any export-conscious country like the UK. Through their attention to the practical needs of the moment, traders are pioneering a bridge across the chasm politicians are finding it difficult to cross.

WHAT UNRESTRICTED SELLING MEANS

Resale price maintenance of any sort is illegal in Canada. What it has come to mean for the electrical industry in that Dominion is graphically outlined in a Board of Trade survey published last week, which is mainly concerned with evaluating prospects of British electrical domestic appliances selling there. In an answer to those who boast Canada as the example of benefits that follow from Government interference with the freedom of a trade to regulate its practices, the survey gives these facts: "The loss-leader principle is widespread, when price may go down to or below the retailer's cost. Small appliances are particularly susceptible to this, and may be used as such by retailers outside the ordinary appliance field. Difficulties such as this have driven some specialist retailers out of the small appliance field."

The result in Canada is, incidentally, to make it difficult for foreign manufacturers (excepting US) to break into the market. The secondary effects of such practices include an extension of sole-distributorship agreements, insisted on by large retailers needing protection against under-cutting by what the survey calls hit-and-run competitors. There is also a ruthless pruning of margins that prevents the functioning of commission agents who might build up a local demand for an overseas product. So far as the Canadians themselves are concerned, there is a growing dissatisfaction with such aspects of the present state of affairs and a demand for amendments to the much-boasted legislation that has given rise to this undisciplined picture of trading. The survey puts this movement succinctly: "A demand for a return to a degree of manufacturer-maintained prices to restore adequate profit margins." This commercial horror story, presented in the sober small type of a BoT factual report, deserves to be pondered carefully by any who feel equanimity at the changes being forced on the electrical trade in this country.

CUTTING TRANSMISSION MARGINS

Sweden has been operating her 400 kV transmission system for eight years now. From the first, this has represented a courageous move by a comparatively sparsely populated country to make the maximum use of her natural resources. What stands out in the description of experience with the system which Mr G. Jancke, of the Swedish State Power Board, presented to the IEE Supply Section last week, is the way in which the engineers concerned have continued the boldness involved in the original decision, in a willingness to cut design margins as experience indicated that those used were unduly generous. This has shown most strongly in the continued reduction in insulation levels, which are based firmly on internally generated over-voltages rather than considerations of lightning. Set at 1,755 kV for station equipment in the original design, there is now talk of reducing the figure to 1,300 kV, partly on a basis of better operating techniques. Stability limits are proving less hampering, and the original 600 MW optimum capacity for a single-circuit line has been increased to 1,000 MW through larger conductors and a change to triple bundling. Experience with the use of series capacitors has answered the reservations of many engineers to the extent that no faults have occurred in the last eight years, although the 400 kV series capacitor stations are operated remotely and are visited only once a fortnight. With this satisfactory record of improved economy at hand, it is no surprise that the Swedes see little future for h.v. d.c. transmission or need of higher voltages.

ELECTRONICS IMPORTANCE

The rate of growth of the Instruments, Electronics and Automation Exhibition in its six years of existence well reflects the liveliness of the electronics industry, which it so largely represents. This year's display is more than double the size of that two years ago, and the magnitude of the overseas representation gives an independent endorsement of the importance of the occasion. The "automation" side of the title is being played down this year; it has suffered the fate that overtakes such phrases as "streamlining"; but, for all that, there is no lack of new developments to attract the visitor. Perhaps the demonstration being given of three-dimensional television displays for industrial applications is the most exciting demonstration of the way in which techniques until recently involved and uncertain, are being incorporated into practical everyday workshop equipment. Smaller illustrations of this same evolution abound, as in the steadily growing availability of controllable semiconductor rectifiers, and the different types of static switching devices available for building into logic control circuits for electrical equipment—one of the more subtle forms of automation. The wide range of equipment covered by the exhibition includes many items in which the power engineer has an immediate interest, and the whole show underlines the way electronic gear is penetrating to his field.

PROVIDING FOR STANDARDS ENGINEERS

Engineers engaged in standardisation of procedures in engineering organisations have no obvious technical association in this country. Of recent years, the organisation of a conference for them jointly by the British Standards Institution and the Institution of Production Engineers has provided some sort of a common platform; and there has been a slowly growing interest in the US Standards Engineers' Society. Now the proposal has been evolved that, instead of forming some new association to add to the many already claiming the attention of engineers, or extending the link with the US, there should be a new class of membership of BSI, associateship on a personal basis, through which the technical interests of standards engineers could be brought together. There seem many arguments in favour of this move, for it recognises the link that inevitably exists between men doing this type of work and the activities of the BSI, while it leaves undisturbed the relationship of such men with their primary professional organisations. However, the development represents a considerable advance by BSI, another step along the path of intervening actively in the engineering and commercial life of the country rather than presenting machinery and organisation that can meet the need for standardisation when industry and others decide that it is needed. The more positive role that the Institution is adopting in this way in many fields is certainly increasing its influence. Provided it is pursued with reasonable moderation it should not interfere with BSI's most important asset, its good relations with industry and freedom from suspicion of having some axe of its own to grind.

Meteor

This week's quick summary of electrical news faces advertisement page 20.

From bar to rod in 95 secs

NEW HIGH-SPEED COPPER ROD ROLLING MILL

SIXTY years after laying down their first mill for rolling copper rod, the BICC Group last week celebrated the formal opening of their latest rod mill at their works at Prescot. This is the fourth rod mill to have been installed by BICC and has double the output of its immediate predecessor, whose output of 15 tons/h was inadequate for the growing demand for copper rod.

The new mill, which cost approximately £1½ million, excluding working capital, has been laid down in a shop 520 ft long by 104 ft wide. It is fully automatic in operation and has a normal production of 100,000 tons per year. It accepts wirebars—each 54 in. long by about 4¼ in. square and weighing some 265 lb—at a rate of one every 13 sec and takes 95 sec to transform each bar into 1,300 ft of ¼ in. rod for drawing round wire or rolling into strip.

Rolling Operations

From the adjacent stockyard, bars are hauled in 43-ton lots to the charging end, or furnace area, of the mill, where the bars are transferred by means of hoists to one of four furnace-charging conveyors. In view of the capacity of the mill two furnaces were required. These are of the Wellman Smith Owen Corporation's walking beam type with two walking beams per furnace. Bars are delivered, under limit switch control, at intervals of 3⅛ in. and then carried through the furnace in 7½ in. steps by means of the walking beams. The furnaces are oil-fired, raising, in one hour, the temperature of the bars to between 810 and 830°C.

At the discharge end bars are transferred on rollers into a cruciform-shaped turntable situated between the furnaces. The table rotates through a quarter-turn to place the bars in the correct position for entering the mill train. An electro-pneumatic ram pushes the bar onto a single roller-driven guide which carries the bar to the first stand, a three-high, 20 in. roughing mill, through which there are five passes to reduce the bar cross-section to 2·5 sq in., its length now being about 30 ft. The time taken from the turntable is 30·45 sec.

Duplicate Trains

The rod is transferred sideways into the entry to the intermediate roughing mill and from this point onwards the mill is duplicated. There are two paths through the intermediate roughing mill, which then separate to feed identical finishing trains. This arrangement permits trains to be set up for different finishing diameters, so that different-sized rods can be rolled at the same time.

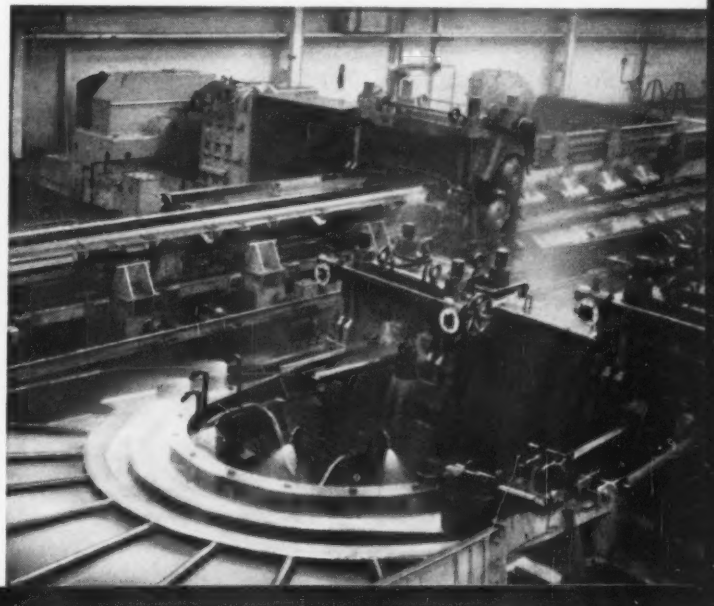
At the entry to the intermediate roughing stage, therefore, a transfer switch automatically diverts the rod into one or other of the two paths through the 15 in. two-high mill. This has two stands in succession, the rod being looped through 180° between them to accommodate the rapid increase in rod length. At the exit from the second stand the rod is 64·7 ft long; time so far is 44·65 sec.

The rod is now passed into the first stand of the 11 in. cross-section intermediate finishing mill, which comprises six stands in all with looping bays between. Looping is done automatically, the traditional method of manually guiding the rod by means of tongs having been eliminated. Through this mill, the rod increases in length to 429 ft in 8·2 sec; total time is now 67.45 sec.

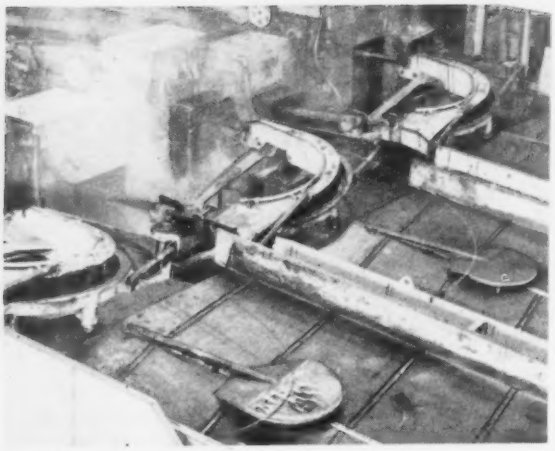
Finishing Operation

Finally, the rod passes into the first of seven stands in the finishing mill train. This is an in-line arrangement, giving continuous rolling, in which the rod accelerates from 180 ft/min to an exit speed of 3,500 ft/min in 2 sec. Each stand employs cantilever-suspended, multi-groove ring rolls, this method of suspension being a new feature in British rolling practice. The stands alternate from horizontal to vertical to avoid introducing guides to twist the section at these high speeds. Four stands are horizontal, producing a round section rod, whilst the three intermediate vertical stands reduce to an elliptical section. When the last stand is rolling to ¼ in. diameter, the two preceding horizontal stands reduce to ⅜ in. and ½ in. diameters, respectively, and rods of these diameters may be taken off earlier in the train, as required. These three stands may also be arranged to roll to 1/16 in. larger diameters in each case, thus giving a total possible variation in output diameter from 7/16 in. to ¼ in. in 1/16 in. steps.

From the finishing train the rod passes to a twin coiling machine in which coils are subsequently quenched and conveyed to a mechanical fork lift, which transfers them onto one arm of a four-arm capstan. As each arm becomes fully loaded the capstan is rotated a quarter-turn, presenting an empty arm to the lift and also allowing the full arm to be off-loaded by means of a stacker truck.



This view, on right, of BICC's new copper rod mill shows, in background, the entry side of the roughing mill, with the two stands and looping bay of the intermediate roughing mill in foreground



Here are shown the inter-stand repeaters and looping bays on one side of the cross-country intermediate finishing train. The rod can be seen passing through

Electrical Equipment

Although the entire mill is automatic, in that electro-pneumatic rams are actuated in response to signals from photoelectric cells which sense the presence of copper rod ready to be moved to the next stage in the process, only the intermediate finishing trains and finishing trains are provided with motor speed control. The roughing mill and intermediate roughing mill are both driven at constant speed by forced-draught ventilated, 600 h.p., 750 r.p.m. (synchronous) slip-ring induction motors, energised at 6·2 kV, three-phase. Total electromotive power for the mill, incidentally, amounts to some 6,000 h.p. and the maximum demand is about 2,500 kVA.

On the intermediate finishing trains, however, d.c. machines are employed. Each train is split into two, with one motor driving three stands from one end of the train and a second motor driving the alternate three motors from the other end. These machines are each 500 h.p., 500 V, running at 1,000 r.p.m. and are also force-ventilated. On the finishing train individual motors are installed on each stand, these being 100 h.p., 500 V machines which are duct-ventilated.

Speed Control System

All nine motors in a complete finishing stage are supplied from a 1,250 kW grid-controlled mercury-arc rectifier cubicle. The control of the d.c. output, effected through a master rheostat in the grid circuit, thus provides means of varying the speed of the complete finishing stage as one unit.

Further individual control of each 100 h.p. motor in the finishing train is also required to obtain accurate speed matching from one stand to the next. This control is obtained by means of a booster generator connected in series with each armature. A pilot exciter connected to the shaft of the main drive motor provides, in each case, a speed reference signal. This is used as the input to a magnetic amplifier, which is of the push-pull type, feeding the split fields of its associated booster. In this way, variation of speed of the drive is fed back to vary the booster excitation and thus add to or subtract from the rectifier voltage across the drive motor armature.

Coiler Operation

Operation of the twin coiling machine, which has to be accurately synchronised with that of the finishing train, is governed by limit switch and photoelectric cell control of Ward-Leonard systems which supply the coiler motors, which are 65 h.p. machines. Each coiling unit has two coilers situated on each side of a common quenching bath. Rod is fed from the last stand of the finishing train through a diverter to one of the coilers, which winds a coil of 2 ft internal diameter by 3 ft external diameter. The coiler motor rotates at 1,400 r.p.m. and is coupled to the coiler so that the coiling speed matches the linear speed of the rod, thus ensuring that tension in the rod is eliminated or kept to a low value.

As soon as a p.e. cell detects that a particular length of rod has passed through the last stand and has therefore been wound, the coiler motor armature circuit is opened and the motor brought to rest in about 6 sec by a combination of dynamic and mechanical braking. At the same time, the drive for an electro-pneumatic actuator is energised to move the diverter into its alternative position, ready to direct the next length of rod (which follows 26 sec later) to the second coiler.

The coil is wound horizontally on a baseplate through which eight studs rise vertically to provide a supporting cage. As soon as the wound coil comes to rest a further actuator lifts the baseplate clear of the top of the studs and level with an electro-pneumatic ram which pushes the coil off the baseplate and onto the perforated platform of the quench. As soon as the coil is clear of the baseplate the ram withdraws, the baseplate returns to its original level, re-exposing the coiler studs, and the coiler motor is accelerated in a further 6 sec to the coiling speed, ready to receive its next length of rod.

General view of one of the continuous finishing mill trains from the entry end. Note the individual motor drives and ventilation ducts at top of each stand

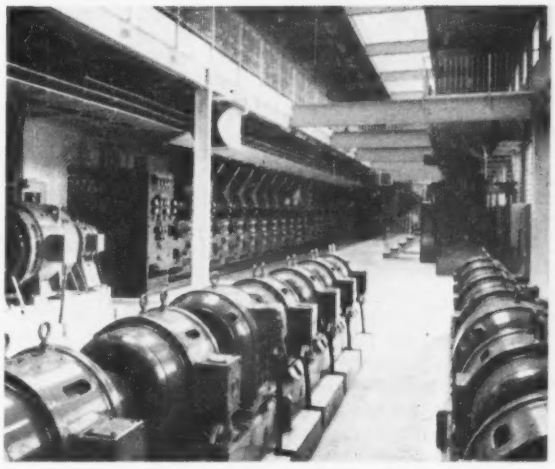
Since the two coilers share alternately successive lengths of rod, it will be appreciated that the complete cycle from coiling to coiling has to be completed in 52 sec. At the same time, of course, the quench platform has to be allowed to descend under gravity into the bath, cool the coil for as long a time as possible, ascend to its original position and allow the coil to be ejected onto the dog conveyor in sufficient time before the next coil from the other coiler is ready 26 sec later. This quenching cycle is initiated by the ram which transfers the coil from the coiler baseplate onto the quenching platform. The end of travel of this ram is detected by a limit switch which allows the platform to descend. Similarly, return of the platform, effected electro-pneumatically, is also sensed by limit switch, to initiate the push-off ram which transfers the coil to the conveyer.

Supervision of the mill operation is carried out from three pulpits. One is sited on an observation balcony which runs the length of the mill on one side of the mill building, and this overlooks the two roughing stages. Controls are provided in the pulpit to start the mill, together with indication of various motor speeds and other values. The other two pulpits are sited side-by-side in the centre of the mill area, each overlooking one of the duplicate finishing stages. Apart from stopping and starting, controls are provided here for adjusting the speeds of the two trains in each finishing process.

Electrical Plant Room

All electrical equipment is housed in a two-storey extension, 200 ft long by 30 ft wide, which abuts the balcony side of the main building. It houses main 6·2 kV switchgear, rectifier cubicles, a.c. and d.c. medium voltage switchgear, liquid starters for roughing mill motors, magnetic amplifier panels, supervisory board and control gear panels. All cabling (of which there is a total of some 32 miles) is housed in the basement of the extension, and comprises p.v.c. insulated, armoured power cables, s.w.a. paper-lead cable for 6·2 kV supplies and butyl rubber insulated cable for the rectifier plant. Their associated 1,500 kV transformers and power correction capacitors are housed outside.

The basement also houses the ventilation plant incorporating three motor-driven fans and filters. Additional booster fans divert some of this air into the ducts of the finishing mill motors. Automatically controlled louvres allow the filtered air to pass from the basement into the equipment rooms above at a maximum rate of 55,000 cu ft/min. Apart from ventilation air system there are also two compressors, with a third as standby, each delivering, at a maximum rate of 300 cu ft/min at 80 lb/sq in., into a ring main supplying the electro-pneumatic actuators. There are also five pumps, each of 600 gall/min maximum, for circulating the flood lubrication system of soluble oil in water, and a further four pumps are installed to circulate the quench bath water at 15,400 gall/min for cooling from 146°F to 96°F in a forced-draught heat exchanger.



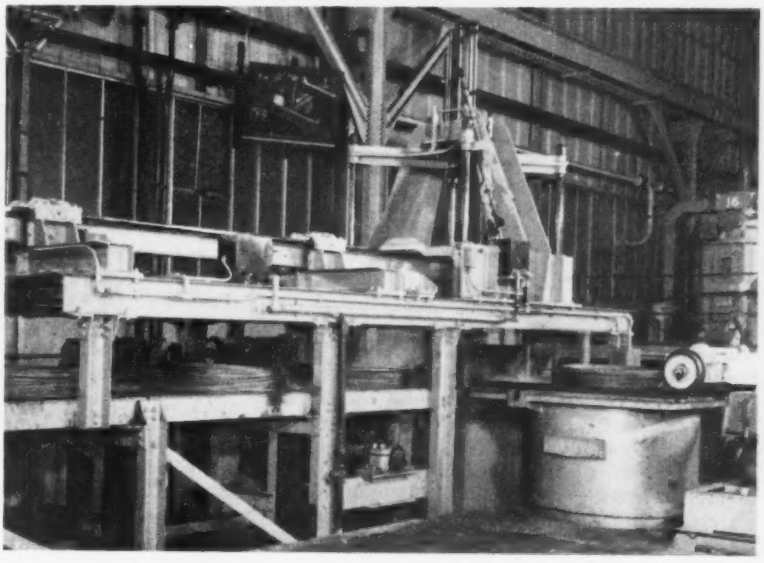
Electrical plant room for BICC's new copper rod mill. In foreground are booster generators for controlling speed of finishing mill motors; in rear, d.c. switchgear and magnetic amplifier cubicles

Included in the mill building proper is a maintenance bay catering for stand assembly, guide assembly and roll storage. It includes facilities for storage and assembly of spare stands, and the storage, grinding and assembly of such components as guides and strippers.

Official Opening

The official opening of the mill was carried out by the Rt Hon Reginald Maudling, President of the Board of Trade, who commented that this mill, being the largest of its kind in the world, was a compliment both to the company and to the British cable industry as a whole. He also mentioned the firm's concentration on reliable quality of product and on assessing service conditions of their products.

The mill was designed in collaboration with the Brightside Foundry and Engineering Co. and installed by BICC. All electrical machines, switchgear, rectifiers and the major part of the control equipment was supplied by the English Electric Co., with use also being made of Brookhirst-Igranic equipment. Construction of the mill building was carried out largely by Sir Alfred McAlpine.



Coiling unit, showing completed coil on coiler baseplate at moment of being pushed to the left on to quench platform, whose electro-pneumatic ram can be seen above. Other coils are seen on conveyer

New thoughts on lighting levels

LIGHTING CODES COMPARED AT I.E.S. SUMMER MEETING

SOME 300 acceptances were received by the Illuminating Engineering Society's invitation to the summer meeting held this year at Harrogate from 15-18 May. The programme included the usual informal evening assembly at the Majestic Hotel on the Sunday, a visit to the floodlit Fountains Abbey on the Monday and the dinner and dance on the Tuesday, when the president of the IES, Mr H. G. Campbell, and Mrs Campbell received the guests. The more serious business, apart from the annual general meeting, was the informal discussions on subjects under consideration by panels of the society's technical committee, later summarised by the chairman, and the reading of three papers. One of these, by H. C. Weston, O.B.E., F.I.E.S., on "Rationally Recommended Illumination Levels," made interesting comparisons between modern thoughts from American, Russian and British sources on the best levels of lighting to recommend for specific locations.

Lighting and Environment

A lighting engineer who happened to be a bit of a cynic once remarked: "The lighting man who really knows his job goes through the motions of calculating the required number, size and location of lighting fittings and then uses his own judgment for, in matters of illumination, the eye is a better tool than the slide rule." In this he was probably correct, but he never explained how the eye could help when all there was to go by was a specification.

Mr Weston obviously shares this view to some extent for, in the opening paragraphs, he says: "A serial order of illumination levels has characterised every prescription system that has applied hitherto. But it is not indispensable; illumination might be prescribed very simply—as indiscriminately and as lavishly as Nature sometimes does it." Unfortunately, Nature can afford to do so for she (or it) is responsible both for the human visual system and the illumination; man can only legislate for the illumination when Nature's light is no longer available or has fallen below the level of requirement for visual acuity.

So man has made the best of it by endeavouring to establish units of brightness, and to apply them to levels of illumination each of which has some reference to various relevant criteria. Some of these include the avoidance of occupational eye-strain, the level for adequate maximum visual capacity, for creating a comfortable and restful environment, and adequacy for particular visual tasks. It is the latter which provides the greatest field of application of the lighting engineer's skill since it covers not only the wide variation in visual tasks, from the instrument maker working on his tiny parts to the civil or mechanical engineer working in the open space or large workshop, but also the reflectance effects of the background and surrounds.

Mandatory minima of lighting levels in factories were initially chosen in this country to satisfy the first condition and it still remains the primary one for protective purposes. A tired eye is the first step to an accident. But the levels recommended on this basis alone are still considered as being below those which would today be accepted as good practice. The second is unnecessarily exacting for the evidence is that, to fully meet this requirement, the value would have to exceed 1,000 lumens/sq ft. Despite this, there are those who are prepared to advocate such a high standard.

Environmental consideration is a criterion which has been adopted by the British IES and has also become one of the criteria for statutory minimum illumination in factory working areas but, by itself, it does not lead to recommended levels functionally desirable for specific visual tasks. An additional criterion, which the author describes as "adequacy for a standard degree of 'supra-threshold' visibility and an associated standard visual capacity," has had advocates in America and "is explicitly the criterion of the latest method of development in that country for recommending levels of illumination"!

Obviously the lighting levels to be recommended should preferably be based on field observations but, the author says, there are serious difficulties in making these observations and getting unequivocal results from them. So one has to fall back on laboratory situations, though no-one is under any illusions as to the lack of conviction such values may carry with many people.

Recent New Recommendations

A complete revision of previously recommended levels of illumination was undertaken by the American IES in 1959. These were based on a new method of specification propounded by H. R. Blackwell in the *Illuminating Engineer*, but not entirely so, for all valid illumination research findings, known lighting principles and "vast experience" were used to temper the theoretical values derived from the Blackwell method. In effect, this raised past recommended levels by an average factor of about 3.

In 1959, also, the USSR brought into operation new recommendations for lighting levels, referred to as "norms," which applied to new or reconstructed industrial buildings, residential accommodation and public buildings and also to open spaces. Minimum values ranged from 10 dekalux (10 lm/sq ft) for rough work to 300 dekalux for fine work "where the angular subtense of detail is 1 min or less and the contrast is low with a dark background." Superhigh levels are not prescribed for, though they may ensure finer discrimination, they tend to produce nervous fatigue.

An unusual feature is the prescription of two scales of minima, one for fluorescent and one for tungsten filament lighting. Except at the lower end, tungsten lighting values are half those for fluorescent. The reason for this is not given, though fluorescent lighting is recommended for fine precision work, and it may be that this is related to lighting load rather than psychological factors, despite the claim of Soviet physiologists to have found a difference in visual perception levels for equal brightness from either source of illumination.

The Soviet "norms" are accommodated within a fairly narrow range whose limits are in the ratio of 30: 1 and the prescribed values are mandatory. In this they differ from British and American codes which are not obligatory but, as minima, they must be regarded as high compared with Western practice.

Amenity Luminance

The 1945 IES Code recommended 6 lm/sq ft as the minimum for general illumination over the interior parts of factories generally in which persons are regularly employed without prejudice to any additional illumination required by the nature of the work. In addition, there was the recommendation that all the principle surrounding surfaces should be light in colour. In the 1955 Code, 6 lm/sq ft is still the recommended level but a more generous quanta of general lighting is advised to enhance the feeling of well-being engendered by a bright interior.

Although it is still current practice to base the minimum level of general illumination at 6 lm/sq ft, it is the author's view that this figure should be changed from the photometric unit (lumen) to the brightness unit (ft-lambert). If we assume an average reflectance of 0·5 from the surrounding surfaces, this would mean an increase in the light output from 6 to 12 lm/sq ft while, for the location where reflectance is above or below this, automatic adjustment of the lighting level would have to be made for the same standard of brightness reflected from the working surfaces. There is, however, no magic in the number 6, and higher values might well be used as good practice.

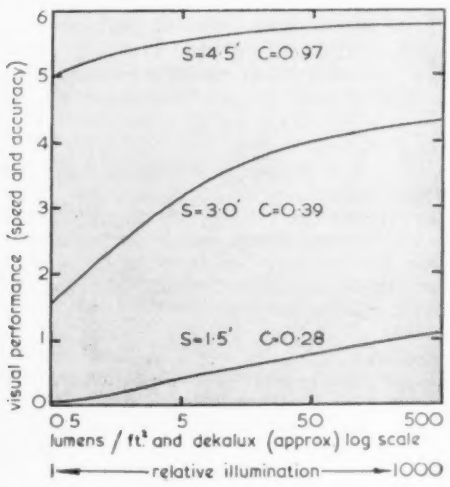
Working Level Illumination

Illumination levels set by the surrounds and background are not adequate by themselves. On the working plane other factors, which may be termed "lightness" and "contrast," must be taken into account. For very small objects, a high degree of illumination is necessary for viewing. If this is done against a light background, discrimination of detail will be impaired and eye fatigue may also result. By contrasting the background colour with that of the object, lower levels of illumination may be applied with improved discrimination of detail and reduced visual fatigue. The two can be resolved into a single factor, which is the reciprocal of the difference between the two reflection factors involved in a contrast, and the effect of applying this factor is to yield levels of illumination which give to all contrasts a common luminance difference, the value of which is a function of the size of the detail involved. However, this does not completely compensate for all differences of contrast, though it operates in the right direction. The tendency would be to adopt excessively high levels of illumination where contrast was poor, which would be offset by the eye's natural compensation against excessive stimulation. Conversely, the reduction of the illumination level where contrast was poor to stimulate eye sensitivity would be equally irrational. A compromise is obviously necessary and, in the author's 1943 paper, an upper limit of 10 was suggested for this factor, a suggestion adopted in the IES Code.

Mr Weston then proceeds to develop this theme and eventually arrives at the point where, assuming that the size-luminance law holds, the maximum illumination required will apparently be of the order of 5,000 lm/sq ft, though it is immediately suggested that illumination levels in excess of 2,000 lm/sq ft can only be justified in the rare case. Moreover, it is evident that, whereas the calculated lighting level for a particular task at a particular station could be determined mathematically with reasonable accuracy, in the practical case of a workshop or bench, lighting levels must be a compromise between the needs of the largest and smallest, highest and lowest surface reflectance values of the many different components which will be visually examined at that point. Further, the lighting engineer is not concerned so much with the standard luminance at the object as with the illumination he has to provide to achieve it.

A number of investigators have endeavoured to classify the relative effects of different illumination levels on task performance speeds with objects of different size and contrast and all come to the same conclusion; whereas it is evident that the performance time of the more difficult tasks under the maximum illumination is lower than the performance time of easier tasks under a much-reduced illumination—in the author's graph the ratio of illumination is 1: 1,000—it is impracticable to arrange for adjustment of illumination to yield equality of performance for greatly differing visual tasks.

Recommended lighting levels derived on a mathematical basis must, therefore, be somewhat arbitrary and subject to adjustment from time to time in the light of experience. Such adjustments have been made in recent editions of the British and American codes and they are made for believedly good reasons, not just for the sake of change. But, as the author says, mere multiplicity of factors to allow for this and that will not necessarily make an illumination specification more scientific.



Relation between usual task time and illumination for objects of different size and contrast (Weston)

Recent Lamp Developments

In his paper, "Progress in Electric Lamps," Mr H. G. Jenkins, M.SC., F.INST.P., M.I.E.S., briefly reviewed the progress in electric light sources over the past 25 years. The development of the tungsten filament lamp for general service use has been mainly confined to improvements in envelope shape and size. Perhaps the most important development in this field, however, is the practical application of Langmuir's discovery in 1915 that the presence of iodine in the normal gas filling reduced evaporation of the tungsten filament. Lamps based on this, with small quartz envelopes, are now being developed for projection.

In the h.p.m.v. field an interesting new development is the pulsed, water-cooled cine-projection lamp which, by pulsing 2·5 milliseconds discharges at the rate of three per frame, gives high intensity, excellent colour-rendering light and needs no shutter.

Mr C. L. Child, B.SC., PH.D., A.P.I., also read a paper on "Plastics, Yesterday, Today and Tomorrow."

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

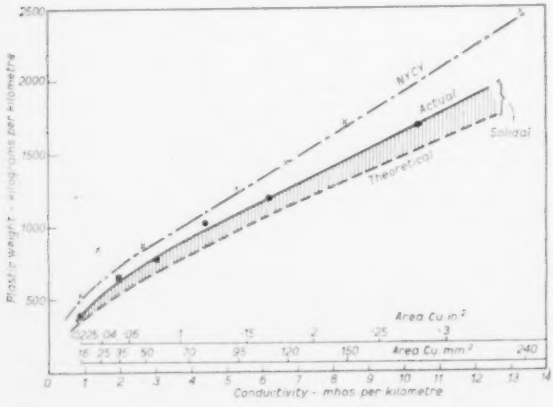
Consulting Users

IT is surprising to us to learn that *Peregrin* feels so pleased that manufacturers should give excellent and appreciative reception to users' views, particularly of boxes for switches and sockets, for we have exhibited for the last three years, a special panel at the ASEE Exhibition showing switch boxes and 13 amp socket boxes to BS 1299/BS 1363 with single, terminal, twin terminal, "Y" entry, and twin through entries in grip, screwed and universal cleats as well as the same number of entries for rubber grommets, both in the vertical and horizontal position. One of our reasons for showing at the ASEE exhibition is not only to show our manufactures to the trade, but to receive information and the views of the users as to what they want; and if possible to manufacture the items they do require in the way they require them.

N. French,
DIRECTOR, F. C. BLACKWELL AND CO. LTD.,
LIVERPOOL, 23.

Solid Conductor Cable

ON 4 June, 1959, you published an article on the new "Solidal" cable. Since that time there has been much discussion as to the relative economies of the Solidal form of construction. It was claimed that, apart from the fact that aluminium conductors are less than half the price of equivalent copper conductors, considerable savings of plastics were possible; but as no comparable copper cable was in regular production in England, this could not be factually substantiated. It did not seem that it could possibly be true.



Weight of plastic insulation in "Solidal" and other cables

Now it happens that a cable of this configuration is quite widely used in Germany. It is called type NYCY. It is just the same arrangement as Solidal but has stranded sector copper conductors and a concentric neutral of round wires or flat tapes. The required plastic thicknesses are almost identical, but favour copper slightly.

Weights of the plastic content of NYCY cables are available from German cable makers, and now that samples of Solidal obtained from numerous different producers have been dismantled and weighed, it is possible to compare cables of equal conductivity. We have done this in the attached graph drawn on a base of conductivity. The Solidal figures are represented as an envelope between the highest actual values measured and the theoretical minima specified.

This seems to demonstrate beyond any doubt that, in the Solidal cable, aluminium has not only overcome its traditional disadvantage compared with copper, but actually turned it to advantage.

The only explanation possible seems to be that apart from the space-saving of solid compared with stranded conductors (which is not enough alone to account for the phenomenon), the precision with which the solid sectors fit together reduces the overall diameter. This is important since the total area increases as the square of the overall diameter, and the metal area is constant. Thus, if the diameter of a cable is increased from say 35 mm to 37 mm due to imprecise shaping of the sectors, the plastic required would theoretically be increased by as much as 18%.

S. F. Rice, ALCAN S.A.,
ZÜRICH, SWITZERLAND.

Protection on Shipboard

I HAVE recently read Mr Hughes's article (7 April issue), which I found to be most interesting and admirably presented. Under the heading "Protection Problems", I would like to draw attention to the fact that the standard range of switchgear available according to British Standards is 15·6, 26 and 31 MVA at 415 V, and thus the upper limit of 35 MVA given in the article is rather on the high side. On the other hand, however, certain manufacturers have, by new design techniques, been able to improve upon the 31 MVA standard, and thus circuit-breakers having breaking capacities much in excess of this are now available.

It was further noticed that no mention has been made in relation to "peak-making current," which under the worst asymmetrical conditions may be as much as 2·55 times the symmetrical breaking current, e.g., for a prospective symmetrical fault level of 31 MVA or 43,000 amp at 415 V, the worst initial peak current would be 111,000 amp. The degree of asymmetry depends to a large extent upon the ratio of reactance to resistance of the faulty network, and in cases where the reactance greatly exceeds the resistance (as is the case in marine installations, since all plant and switchgear is in close proximity to the power source and therefore resistance is considered negligible) the peak-making current will be at a maximum. Thus, when selecting a circuit-breaker for a given installation it is absolutely necessary to ensure that its performance is adequately suitable not only for breaking symmetrical faults but, more important still, making and latching under peak asymmetric conditions.

This particular aspect was probably omitted by the author for the sake of brevity, but I consider that the question "making capacity peak" is so vitally important as to warrant mention under this heading.

H. Unwin, A.M.I.E.E., A.I.MAR.E.,
SWITCHGEAR DEPT., ENGLISH ELECTRIC CO. LTD.,
LIVERPOOL, 10

Instruments Electronics Automation

EXHIBITION

23—28 MAY

"LARGEST specialised show in the world" is claimed for the Instruments, Electronics and Automation Exhibition to be opened next Monday by the Rt Hon Lord Mills, K.B.E., Paymaster-General. That this is a claim not lightly made may be judged from the total of 500 exhibitors, including more than 100 from overseas, who will be displaying on 150,000 sq ft of stand space—more than twice the size of the last exhibition held in 1958. In addition to the exhibition, occupying the Grand and National Halls at Olympia, there will be a conference on "User Experience of Electronics." This year's overseas exhibitors come from America and both Western and Eastern Europe and, for the convenience of the large number of overseas visitors expected, a free interpreter service will be available.

CONFERENCE

Tuesday
Electronics in data processing.
Stores control, production control and insurance applications.

Wednesday
Electronics in factory applications.
Machine tool control and electronics in the steel and motor industries.

Thursday
Electronics in Instrumentation and control.
Handling and proportioning, continuous control of electrical machines and remote control and telemetry.

Details from EFFI, Electronics Engrg. Association, 11 Green St, W.1.

RECORDING INSTRUMENTS

INCREASING complexity of modern industry has led to developments from the familiar single channel recorder to elaborate units capable of scanning many functions. An example of a simple single channel spark recorder is being shown by Hendrey Relays, while typical of the more complicated machines is a scanner capable of in-line sequential scanning of 400 points, or selection of any single-point on demand, made by Cambridge Instruments. This company are also showing versions of their electronic recorder said to be suitable for use as a self-balancing potentiometer, bridge or current balance for controlling any quantity convertible into a d.c. signal. The instrument responds to an input signal of less than one microvolt and response time is better than two seconds.

Electronic instruments for single- and multi-point temperature measurement with optional air control or transmission are being shown by George Kent Ltd. A new model introduced has a quick working response of one second. This company are also showing their range of "Commander" electronic instruments which include circular chart recorders and precision indicators with rotating scales calibrated to very fine tolerances. Their display includes an energy regulator for the manual proportional control of air operated two- or three-term control system, which can be added to plant originally designed to operate with only on-off control such as furnace stoker feed systems.

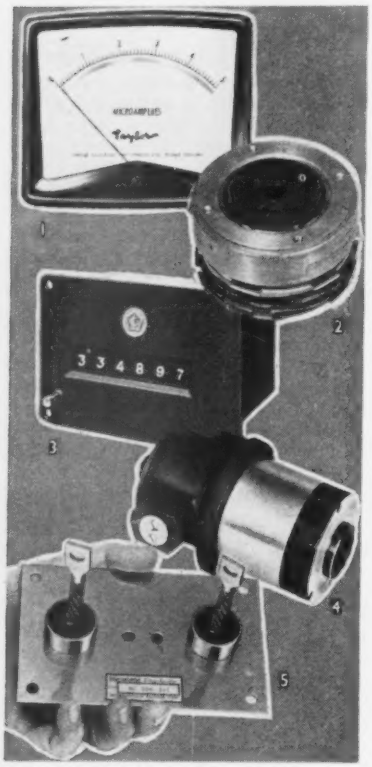
A compact recorder, the type H "Speedomax," measuring 12 in. by 11 in. square, is being displayed by Integra, Leeds and Northrup. The recorder has plug-in components and moving parts operated from a common shaft driven by a high speed balancing motor. A recent introduction is the "Xactrol" controller made by Ether Ltd. This is a potentiometer recording controller with patent zero-load and zero-differential control system, and is an item in a range of temperature measurement and control instruments which include many voltage and potentiometric models. AEI Instrumentation Division are showing a new d.c. potentiometric recorder with a 4 in. chart, multi-colour printing and several unusual design features.

The range of graphic recording instruments made by Everett Edgcumbe is now available fitted with a new high-efficiency movement giving greater sensitivity and response than earlier models. An unusual recorder, details of which are available, is by Laurence, Scott and has been developed for the National Coal Board. This instrument is flame-proof and includes current transformers and instruments for measuring power on

Development model of the temperature scanning equipment for Hinckley Point nuclear power station which will scan 600 thermocouples in two minutes

3-phase supplies up to 3·5 kV 400 amps. The same company are displaying a number of amplifiers for use with speed control equipment. For the control of processes or machines, up to 20 in number, F. C. Robinson are showing their Autovisor operation recorder utilising an electrically operated pen moving at a speed appropriate to the process being monitored. These instruments are available in single-pen strip, chart and disc or up to 20-pen strip and chart models.

An instrument being used in conjunction with the linear particle accelerator at Harwell to give warning of bearing overheating has been developed by West Instruments. It is a multipoint scanner capable of monitoring up to 12 positions and utilising enclosed mercury switch assemblies in preference to a uniselector to overcome possible difficulties due to contact resistance or corrosion. Possible applications include the measurement of bearing temperatures in turbines, motors and gear-boxes, and for these and similar applications two types are available. A single maximum temperature can be set and if this is exceeded by any of the scanned points, an alarm operates.



1. New style Taylor panel meter with sensitivities from 5 microamp

2. Multiple disc oil type electric clutch exhibited by Warner for the first time

3. Counter with mechanical or electrical reset by Counting Instruments

4. Laurence, Scott and Electromotors heavy duty, a.c. industrial tachogenerator

5. Low-cost 100 A silicon rectifier, with heat sink, by International Rectifiers

METERS AND INSTRUMENTS

TYPIFYING the remarkable advances in instrument technology over the last few years is a 3-D microscope developed at Cambridge University. An apparently solid image appears in a cube of space, formed by the movement of a screen which vibrates in unison with the optical focusing system of the microscope. Biological research prompted development of this instrument, but already other applications are being suggested, including assembly of small wave guides and in assisting operators to assemble minute components used in transistor manufacture. For rapid measurement of temperature under difficult conditions, DSIR are showing a resistance spear thermometer utilising the variation of resistance of a minute copper coil mounted in the tip of a hypodermic needle.

Thermocouples for use up to 2,800°C are being shown by Engelhard Industries with a range of integral-sheath thermocouples approximately $\frac{1}{16}$ in. diameter, and gas detection meters. More conventional are the temperature controllers and thermometers shown by British Rototherm and Fosters. Fosters are showing their "Self-Setting Teloscale" for temperature measurement of several different metals at a single point. Electric contact thermometers and a variety of other thermal measuring instruments are being shown by G. H. Zeal. The "Bikini" range of small temperature measuring instruments are featured by Fielden Electronics, whose display also includes their "Capacipoise" servo graph recorders, transistorised servo-operated recorders for a.c. or d.c. ranges. These recorders have provision for various chart speeds and electrical contacts for alarm and control.

Fully solid state construction using transistorised and magnetic amplifier designs is a feature of the Electronic Consotrol instruments made by Foxborough-Yoxall, comprising measurement transmitters, recorders and controllers. Among this company's other new products is a magnetic meter for flow measurement in the region of 0·14 gallons per minute.

Displays of the more conventional electrical instruments include those of Evershed and Vignoles, who are showing their Megger and Ducter instruments, their earth loop resistance tester and various recorders, including a three-term recorder controller. Recently introduced is the range of miniature circular-scale moving-iron ammeters and voltmeters by Crompton Parkinson, who are also showing their new flush-mounted "New World" instruments with specially moulded front glass for reading at an angle. Claimed as the smallest meters in production in this country are the Edgwise Indicators shown by Taylor Electrical Instruments for use on crowded control panels. Ernest Turner are showing a further stage of development in their ligament suspended moving coil instruments which is said to eliminate friction but permit high deceleration without damage. Exhibits also include hermetically sealed instruments and a new design of waterproof instruments.

Common deficiencies of electrostatic voltmeters are claimed to have been overcome by Nalder Bros. and Thompson in their new 12 in. portable 1 kV design, which has an accuracy of ±0·3% and an input resistance of 20 million megohms. Edgwise traction instruments with edge-on illuminated scale are in the comprehensive instrument display by English Electric.

Several firms are showing digital voltmeters and among these may be mentioned the four-digit voltmeter by Ferranti covering the range 0·001 to 999·9 V d.c. in three ranges. A three-digit version has an accuracy of 0·1% and an average reading time of 0·7 sec. More electronic digital voltmeters giving four and five decimal digit precision and intended for measurement of computer input and output voltages are shown by Blackburn Electronics. On show for the first time is their digital voltmeter and ratiometer BIE 2116 which is fully transistorised.

Several instruments are being shown for the first time by Muirhead, including an automatic recording wave analyser for graphical analysis of noise and vibration signals and a precision r.m.s. decade voltmeter with a built-in voltage standard suitable for operating on a frequency range from 5 c/s to 50 kc/s at from 1 millivolt to 300 V. Laboratory instruments by Tinsley include their type 5205 potentiometer suitable for voltage measurement to six-figure accuracy.

COMPUTERS

MAKING a first appearance is a transistorised digital computer by Standard Telephones and Cables with the logical design and programming features of the Stantec Zebra computer. The computer has a multiplication time of 624 microseconds and an input-output rate of 20,000 characters per second with storage for up to 240 million characters. The high speed range of business computers shown by EMI includes the Emidec 1100 and 2400, high speed units and the FRED cheque sorter, able to read specially designed type face at many thousand characters per second. Also on display is the Emiac 2 analogue computer for industrial applications.

Two outstanding exhibits on the de Havilland Propellers stand are the "Anatrol" analogue computer for on-line process control, claimed to give reliability and flexibility at low cost, and the "Dame" monitoring equipment for initiating, measuring and recording plant operation.

Two computers are displayed by Ferranti, the Sirius desk computer and the Argus for time control of industrial processes. Both versions are transistorised.

Intended primarily for a study of physical system performance is the AEI Electronics Apparatus Division 955 analogue computer for solving linear and non-linear differential equations. Operation, which may be continuous or repetitive, is selected by controls integral with a high accuracy dual trace oscilloscope. Permanent records of results may be obtained from a two-channel pen recorder of the rectilinear write-out type using heat-sensitive paper as a recording medium. Although not strictly a computer, the transformer analogue network analyser shown by F. C. Robinson is a useful tool for the solving of simultaneous equations with complex coefficients, and can be used in the study of power systems and stability problems.

A transfer function computer, said to operate on an entirely new system, is shown by Wayne Kerr. It computes directly the constant coefficients of the transfer functions of control systems and is demonstrated in conjunction with a vibration meter.

DATA PROCESSING

DATA processing equipment, both for recording the condition of electrical equipment and also for preparing inputs for digital computers, now occupies a key position in control techniques. Honeywell Controls and Bristol Aircraft are showing up-to-the-minute developments in data processing equipment for aircraft flights designed for the Royal Aircraft Establishment. The Bristol "Timtape" is used for converting magnetic recordings of the standard RAE 24 channel subminiature time telemeter system into punched card records. The "Cavalcade" analogue to digital converter, also being shown, has adjustable scaling facilities which allows input data to be corrected to a predetermined calibration curve.

Typical applications for data logging equipment developed by Blackburn Electronics are the monitoring or logging of strain gauge, thermo-couple or transductor outputs. Any faults developing in the monitored equipment are thrown up on an output printer. For use with data logging equipment, Epsylon Industries are showing a tape recorder with up to 16 channels suitable for direct recording or f.m. carrier systems with speeds from 7/8 in. to 60 in./sec. The 1010 data processing system being shown by the AEI Electronic Apparatus Division is claimed to operate four times as fast as other British computers in the same price range. Executives with the Bailey Meters data logging system installed have available a monitor system operating from an office desk dial which can be used to check variables in the equipment at any time. Data logging equipment automatically prints variables in excess of preset values in red. This company are also showing their extensive range of circular chart recorders which have recently been redesigned.

A fully transistorised analogue to digital converter with a sampling period of 20 milliseconds is being shown by Marconi Instruments, and is intended for feeding instruments or processing. The converter is applicable to monitoring of radiation at a number of points in nuclear power stations and is able to translate analogue voltages into digital form for data processing. Another data handling system, by Kelvin Hughes, claims great flexibility in scanning and logging and is said to be usable for an unlimited number of processes giving an accuracy of 0·1% and at higher speeds than on previously available equipment. This apparatus operates on d.c. input from transducers and is rack-mounted.

For sampling large numbers of primary and secondary plant measurements, the Plessey-Hagan Control Company have developed a data processing system called "Kybernetes," which may be linked to conventional controllers giving almost complete self-operation.

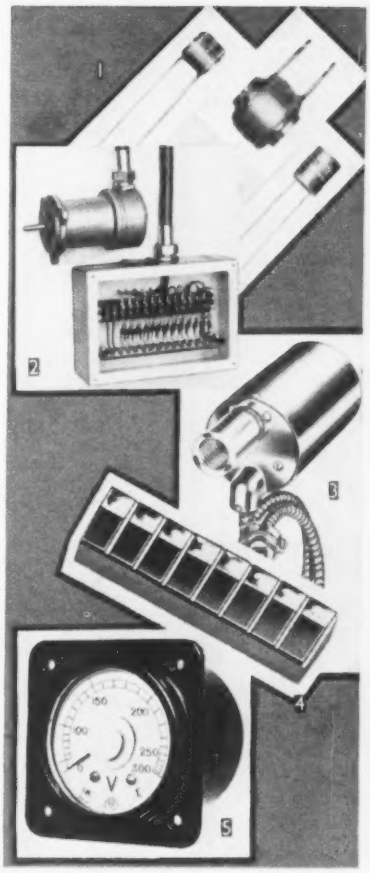
A transistorised data processing system for industrial applications for values such as temperature, pressure and chemical composition is displayed by Beckman Instruments. Digital instrumentation for measuring and recording events-per-unit-time, frequency, time intervals, voltage and other phenomena is also shown.

Accessories which may be used in data processing equipment are being shown by a number of companies; for example, Data Recording Instruments are showing a range of multi-track recording heads and a four-speed multi-track tape deck giving speeds from 15/64 in./sec. to 120 in./sec. The latest tape handling machines have a start-stop time better than 4 milliseconds at 150 in./sec. Instruments and accessories designed for use in data acquisition, processing and computation systems are being shown by Ericsson Telephones. These include digital voltmeters and strain meters. Here again, the equipment has been constructed to carefully designed modules for building into data logging systems for plant monitoring. Inputs suitable for data processing equipment may be obtained from electro-mechanical transducers and pick-ups of the type being displayed by Electro-Mechanisms. This company also manufacture electronic carrier-grid amplifiers.

Multipoint scanning equipment incorporating new "Datapacs" for electronic data logging and processing systems is the most important exhibit of data processing and control by English Electric. These basic logical elements are plugged into standard racks. They incorporate printed circuits, are transistorised packages, and measure only 4½ in. by 6½ in.

GEC show their standard circuit blocks incorporated in a two decade decimal read-out digitiser system which illustrates how a number of such blocks enable different induction digitiser systems to be built up. These units are available in several sub-chassis assemblies for reading 1, 2, 3 or 4 digitisers of either binary or decimal type together with decimal decoders. GEC are also showing a micrometer with decimal read-out system demonstrating how digitisers can be geared together to obtain high resolution. Four digitisers are used, giving a numerical display of the micrometer reading in ten-thousandths of an inch.

A data logging system which can be constructed to give visual and punch tape read-outs of frequency and true time is displayed by Venner Electronics. This system uses in-line frequency meters and a digital clock and can be used in conjunction with digital voltmeters. Venner are also showing their new transistorised analogue frequency meter covering the range 3 c/s to 300 kc/s.



1. Precision wire wound resistors now being made by McMurdo Instruments

2. Brushless tachogenerator with rectifier unit from Laurence, Scott

3. Ultra-violet light in furnace flames is sensed by this Honeywell Ultra-Vision detector

4. International Rectifier silicon read-out element for computers

5. Voltmeter in the Crompton Parkinson "New World" range

COMPONENTS AND MATERIALS

BASIC materials of the electronic industry on display range from the humble terminal and washer to power supplies and precision components. A new low speed precision generator is being displayed by Vactric in their range of servo components, which also includes a.c. motors and tacho generators. This generator has a field system excited from a 50 kc/s supply and is said to be suitable for use over a speed range of 1,000/1 with a bottom speed of 0·01 r.p.m.

The well-known range of Advance "MT" constant voltage transformers has recently been superseded by the "Volstat" range with outputs of up to 100 W. Latest addition to this company's d.c. range of power supplies is a range of transistorised stabilised power packs with current outputs of 0·5 amp 0 to 15 volt.

Turning to components of rather a different type, Beckman are showing their well known "Helipot," a multi-turn wire wound precision potentiometer. Another exhibit is the "Duodial," a dial which indicates clearly in turns and hundredths of a turn the exact position of multi-turn devices such as the "Helipot."

Representative of the many manufacturers displaying basic materials for the industry is Permali, who are featuring newest developments in applications of "Permaflon" (PTFE) for blocks, copper-clad laminates and dispersive coatings. For encapsulated components the company manufacture "Permacast" epoxide resin.

Relay introductions this year by Magnetic Devices include subminiature high temperature relays, printed circuit types for 0·1 in. grids and hermetically sealed plug-in relays.

A new miniature plug-in relay with an operating time of approximately six milliseconds is displayed by Oliver Pell, who are also showing their new range of shaded pole motors supplied either with or without circular gearboxes. McMurdo instruments are showing components and a series of water activated batteries.

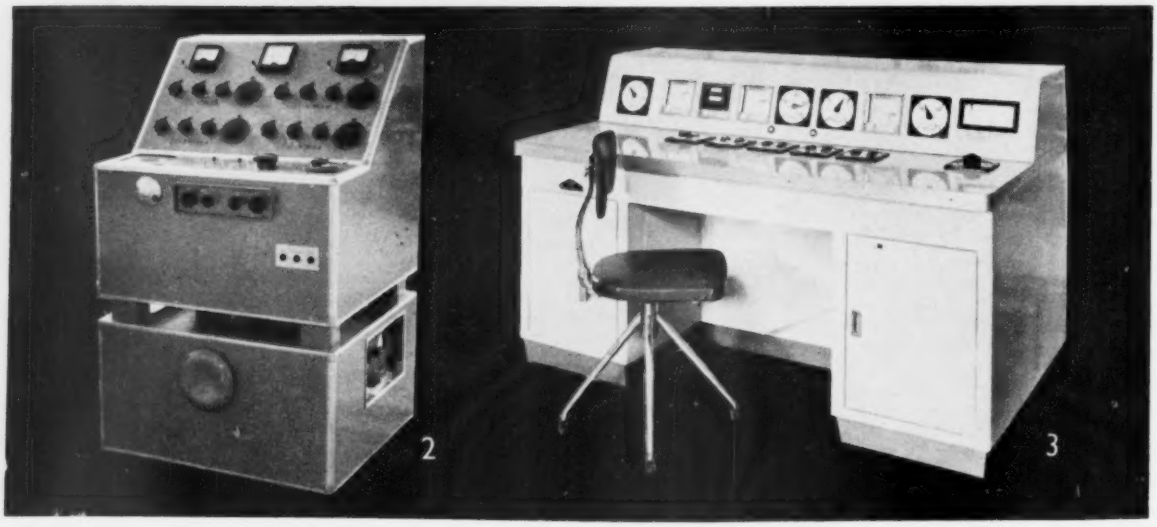
One of the largest displays at the Exhibition will be by the Plessey Company, who are showing their immense range of wiring components and accessories. Among the accessories may be mentioned a range of plastics cased electrolytic capacitors and the high reliability "Hyperlytics" having the advantages of a wide temperature range, low leakage and long life. The Industrial Electronics Division of the company are featuring a selection of output transformers, including units with C-cores. Capacitors for electronic and industrial applications are being shown by A. H. Hunt. These include dry electrolytic capacitors with high ratio anode and plain foil constructions, and motor starting capacitors. The "Melimet Supermoldseal" midget capacitors have unique construction with outstanding insulation resistance and are suitable for temperatures from −40°C to +100°C. Introductions this year include tantalum foil electrolytic capacitors measuring only 0·565 in. long by 0·145 in. diameter and with capacitors varying between 1·5 μF and 12 μF. Capacitors also form an important part of the display by the Dubilier Condenser Co. and some recently developed products include encapsulated paper tubular capacitors suitable for an operating temperature range from −40°C to +125°C for d.c. applications. Sub-miniature electrolytic capacitors for printed circuits and transistor applications with long life characteristics and tantalum electrolytic capacitors supplement the display, which includes power resistors and high stability resistors in the ratings of 1/10 to 2 W. A range of solid carbon, high stability and "Silertex" resistors are shown by Erie Resistors.

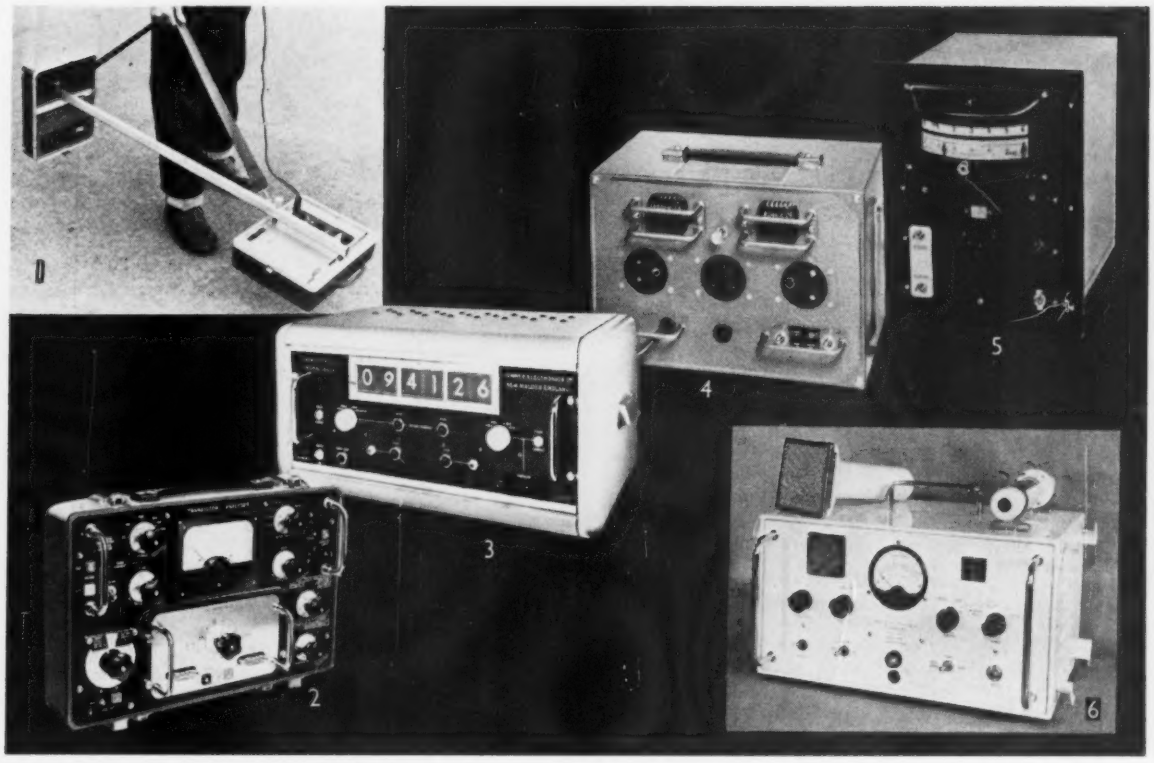
Popular in America and recently introduced to this country is a new heating element made from toughened heat-resistant Pyrex glass by James A. Jobling. The glass is coated with an electrically conducting film similar to that used in the manufacture of the company's range of "Electrosil" metal oxide film resistors, which are also shown. The precision wire wound resistors shown by Alma Components include a new range rated ¼ to ½ W with temperature coefficient guaranteed 0 over the range 0 to 100°C ±4 parts in 10^6/°C.

1. Introview equipment, made by Sperry, being used to check tubes for wall thickness

2. A Teledictor machine-tool control console

3. An Italian designed Unibloc console panel displayed by the Pullin Group





1. Bruce Peebles M-scope pipe-finding and leak-detection unit
2. The Avo transistor analyser
3. Transistorised digital clock made by Venner Electronics
4. Hendrey test set for checking earth conductors and circuits
5. Multi-point scanner by West Instruments
6. Burndept radiation monitor ratemeter

SEMICONDUCTOR DEVICES

SEMICONDUCTORS for industrial applications as well as for the radio industry feature prominently on the AEI Radio and Electronics Components Division stand and include four power transistors, two having current ratings of 10 A and voltage ratings of 80 and 100. The other two are rated 3 A at 40 and 60 V. For high speed switching applications three drift transistors are available for 20, 40 and 60 Mc/s, respectively. A sub-assembly for medium power silicon rectifiers is shown by GEC which permits stacking of these diodes for voltages up to 150 kV and currents of 2 A. Recent additions to the company's range have extended it to 800 V. The extensive range of silicon semiconductor devices made by Ferranti include zener reference diodes, high speed switching diodes, high voltage rectifier assemblies and an ultra-high power silicon rectifier.

Six additions to the range of devices made by International Rectifier Company will be on show for the first time at the Exhibition. They include a series of high-altitude silicon cartridge rectifiers, ceramic encased to prevent surface creepage, zener silicon diodes available up to 1 W rating and a silicon read-out cell for computer and data handling systems with a response time of the order of 10 microseconds.

Of interest to the power engineer is a 100 W silicon rectifier unit complete with heat sink rated at 100 A for operating temperatures up to 130°C, and the "Thyrode" silicon controlled rectifier having an action similar to a thyratron and suitable for load currents up to 16 A at voltages from 20 to 200. Joseph Lucas are showing for the first time their silicon diffused junction rectifiers rated for 35 and 100 A.

Transistors for industrial and computing use are among the new developments shown by Mullard, who have also introduced a new photo-conductive cell for industrial use. This cell is of the cadmium sulphide type, is small, and has a high sensitivity.

Another batch of seven silicon rectifiers have been announced by RCA, Great Britain. They are designed for industrial and consumer products, have a maximum forward current rating of 0·75 A at up to 600 V peak inverse volts.

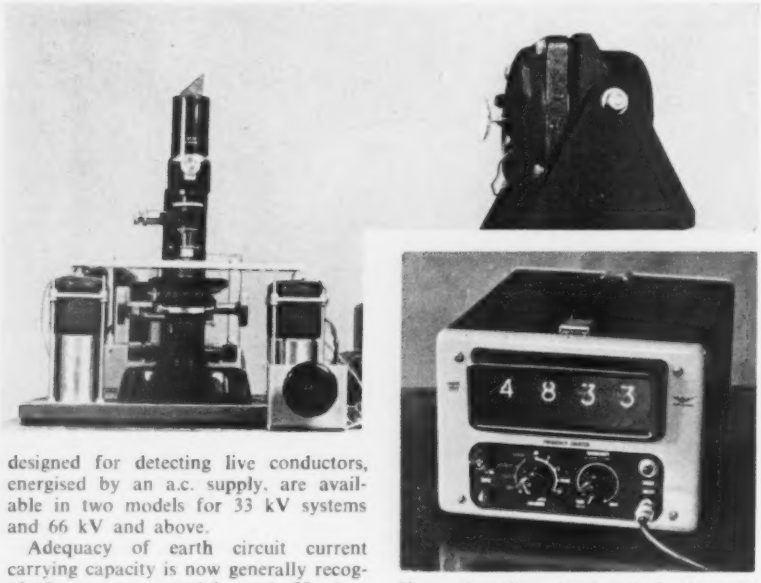
Transistors for applications ranging from control gear to v.h.f. requirements are shown by Newmarket Transistors and a demonstration of the application of transistor inverters to fluorescent lighting is shown by Phoenix Telephones. A series of "Powerpack" batteries for all devices utilising transistors features on the Ever Ready stand.

Transistors are being used by Dawe Instruments in a number of their instruments, notably a transistor power output meter with a power level range from 0·1 mW to 10 W and a frequency range of 10 c/s to 20 kc/s for measuring output power of audio oscillators, amplifiers and networks. Another transistorised meter will measure phase difference between signals in the range 1 c/s to 10 kc/s. For checking transistors themselves, Avo have introduced a compact portable battery-operated tester for n.p.n. or p.n.p. transistors of the small signal and medium power types.

TESTING AND TIMERS

IN a sense, of course, most of the exhibits on display have applications in the test laboratory. But two exhibitors exemplify the requirements of the test laboratory on the one hand, and the service engineer on the other. Wayne Kerr are showing a high precision bridge console for impedance measurement from a few microhms to thousands of megohms at frequencies between 50 c/s and 20 kc/s. Accuracies as high as 0·001% are claimed for this instrument.

For the service engineer, Everett Edgcumbe are showing their "Metrohm" range of insulation and continuity testers which operate from a 500 volt d.c. supply derived from a transistor converter. The "Metrac" hand meter,



Above, three-dimensional optical microscope developed at Cambridge University
ERIE have this model 100T frequency counter and digital tachometer

designed for detecting live conductors, energised by an a.c. supply, are available in two models for 33 kV systems and 66 kV and above.

Adequacy of earth circuit current carrying capacity is now generally recognised as an essential, and Hendrey Relays are marketing a tester which circulates 26 amp at 16 volts through the earth circuit and will reject the circuit if the resistance exceeds 0·25 ohms even if the physical circuit is good. This company are also showing another recent introduction, a multi-stage non-synchronous welding timer for resistance welding machines which will allow repeat stitch welding at 220 spots per minute. The well-known range of "Rodene" timers made by D. Robinson is on display and includes the recently introduced "Varicam" timer which has provision for twelve easily adjusted cams. Time switches are being displayed in their range of instruments by Sangamo Weston. These include 24-hour dial timers, solar dial timers, off-peak tariff and short interval switches.

TELEVISION AND 'SCOPES

AMONG the several closed-circuit industrial television demonstrations this year are two recently developed 3-D systems intended for remote manipulation in nuclear plant. EMI are using a standard closed-circuit system consisting of two camera channels arranged to relay pictures on two monitors. The pictures are then superimposed by a mirror and polarised glass to form a single image. Pye are also showing a 3-D system which uses an optical beam-splitting group of mirrors both at the camera and monitor end, the one at the camera end converts two images for transmission over a single closed loop television circuit, while at the monitor, these two pictures are reconstituted to give a three-dimensional image.

Several companies are exhibiting components, and among the AEI exhibits is a new 110° short neck 21 in. tube with "tri-potential" electronic gun. Among their wide selection of industrial and radio valves, the AEI Radio and Electronics Components Division are showing a new high slope pentode with special frame grid structure.

A low priced 2¾ in. diameter screen oscilloscope for the service engineer is being shown by Direct TV Replacements and contrasts with the traveling wave deflection cro exhibited by Twentieth Century Electronics and intended for presentation of transient and repetitive phenomena in the milli- and sub-milli-microsecond regions. This company is also displaying a series of photo multiplier tubes employing a venetian blind structure. A feature of the "Serviscope," displayed by Telequipment Ltd., is the time base which locks automatically on a very wide range of signals, permitting complex wave forms to be examined. This company is also showing rack-mounted oscilloscopes, and double-beam oscilloscopes as well as a high-beam probe unit. A closed loop television system is featured on the Epsylon stand and includes a high definition camera installation. They are also demonstrating their "Telescribe" system, a device for the remote reproduction of written messages. Letters drawn on a translucent screen are immediately transmitted. Solartron are displaying a wide range of their products for the electronic industry including a number of oscilloscopes. Among the exhibits on the BICC stand are samples of their recently developed television relay cable consisting of four-pair screened cables which may be used in place of two separate screened quads, and several mineral insulated thermocouples for industrial applications, including two recently developed flexible rope-like thermocouple assemblies.

MAINLY INDUSTRIAL

A DEMONSTRATION on the AEI Electronics Apparatus Division stand shows an electronic counter applied to the reversal of rolling mill drives. A recent introduction is the silicon control rectifier shown regulating the speed of a 1 h.p. motor. For monitoring large machine bearing temperatures and similar applications a 10 point alarm indicator is shown.

Crane warning devices are shown by at least two firms, GEC are showing a tension cell for automatic weight registration and overload warning for crane drivers using an electro-magnetic pressure transducer. A high voltage overhead line detector developed by Bruce Peebles gives warning to mobile crane operators when they approach a line, and is operated from a d.c. l.v. supply.

In addition to their range of battery chargers, Automat are showing eddy current measurement equipment for metallic and non-metallic coating thicknesses. Corrosion and flaw detection in stainless steel tubes is now possible with the modified "Introview" equipment made by Sperry. Teledictor are also showing a non-destructive tester for similar applications, as well as control consoles with integral programmes, using punched card control, for inspection of linear or circular contours.

A multiple disc oil type electrical clutch is shown at the exhibition for the first time by Westool. The clutch is suitable for rapid cycling, has high torque capacity, and will transmit 15 h.p. per 100 r.p.m. Westool have also recently introduced a range of encapsulated solenoid coils.

Among the several firms showing liquid and solid level detection equipment is Firth Cleveland, with an industrial electronic gauge for measuring liquid levels to an accuracy of $\frac{1}{16}$ in. Transistorised probe level detectors for liquids and granular solids are also shown. From liquid or solid levelling to fuel failure; Bailey Meters have alarms for use with chutes conveying solid or granular powder which are claimed to be extremely sensitive and incorporate a delay action to safeguard against normal flow variations.

A liquid level and fault annunciator system for a boiler control unit forms part of the extensive display by the electronics and relay divisions of Thorn Electrical Industries.

For the paper trade, Ekco Electronics have developed a nucleonic gauge for indicating moisture content in paper pulp, and Smith's Instrumentation Division are showing photo registration units suitable for electronic machine control with their range of high speed counting machines and tachometers.

Equipment for the workshop and machine tool industry includes the Ferranti co-ordinate inspection machine, capable of checking the proportions of machined parts to an accuracy of 0·001 in. using probes and an electro-optical sensing device. Information is displayed on five figure electronic counters.

Ferranti are also showing an electronic fault detector for locating faults on 132 kV lines using the radar principle of pulse reflection. An automatic commutator undercutting machine for small motors features on the EMI stand and other equipment for industry includes automatic weighing and control systems for a variety of industrial applications.

Industrial electronic weighing equipment and turbine supervisor equipment is also shown by Research and Control. A range of electrical surface heaters made by Electrothermal has recently been extended to include industrial heating tapes for temperatures up to 1,000°C. For electrical equipment, where the temperature may become excessive, an accurate range of temperature controlling thermostats up to 20 A rating are shown by Otter Controls. Occurrence of an actual fire is quickly detected by the sensitive ionisation chamber system developed by Minerva Detectors, claimed to be particularly suitable for protecting process control and electronic computing equipment.

NUCLEONICS

MANY exhibits are devoted to application of nucleonic measuring techniques to industry and instruments for use in nuclear plant.

In the first category come the extensive range of radiation monitors and nucleonic thickness gauges made by Burndept. Radio isotopes have been applied by Ekco Electronics to the gauging of running sheet materials and pipe coatings. Their range of radiation nucleonic instruments includes scintillation counters, rate-meters and scalers. A scintillation counter feeding a rate-meter and governed by burst-slug detector equipment is shown by Marconi Instruments in a display of typical instrumentation for nuclear plant.

A complete control rod mechanism for a nuclear power station is featured on the Elliot Automation stand. AEI Instrumentation Division are showing a burst-cartridge detector computer of the type being installed at Berkeley nuclear power station.

Automatic voltage and frequency regulating equipment for marine, ground and airborne applications made by W. H. Sanders

COUNTERS AND CONTROL

A FEATURE of the Advance Components range of exhibits is a transistorised counter having a frequency range from 10 c/s to 1 Mc/s. The counter takes advantages of transistors and printed circuit techniques to keep down size and it also includes self-checking facilities. Six decade meters give the count to an accuracy of ±1.

The building block system has been applied to counting to give quicker and cheaper specialised equipment by Ericsson Telephones. Standard dimensioned printed circuits are used and typical examples of these and other counters are displayed. An extensive series of batch counters with rates varying from 300 counts per minute to 20,000 are shown by the Electronic Machine Co., who are also showing process timers, data storage equipment and calculating machines.

Transistors and printed circuits are employed in two events-per-unit-time counters, of American manufacture, by Erie Resistors. Venner Electronics are also showing transistorised timing, counting and frequency measuring equipment covering time measurements down to 1 microsecond and frequency measurements to 1 Mc/s. The entire range of electrical and mechanical counters made by Counting Instruments will be on display including the latest models, in-line digital display unit and a high-speed push button electro-magnetic counter. The recently introduced series 1,200 counter has been specially designed to meet requirements for reliable reset counting.

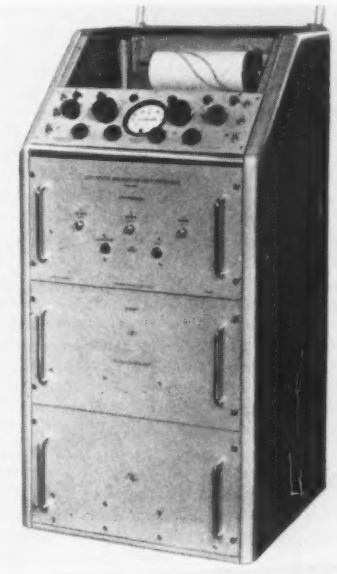
An interesting development by DSIR is an automatic self-checking counter in which all parts of the circuit are checked automatically before each count is made. The instrument employs transistorised decade units and the output can be coupled directly to an electric typewriter.

Control systems displayed at the exhibition are many and varied ranging from small electric motor controls to comprehensive control systems for boiler and other industrial plant. Bristol Aircraft are showing a coded punched tape programme equipment for the control of heat and load cycling.

Process and steam raising control equipment is demonstrated by Bailey Meters by a working simulation of the process. Electronic transmitters are shown including three-term controllers, converters and regulating units. This system is fully transistorised and printed circuits are used throughout.

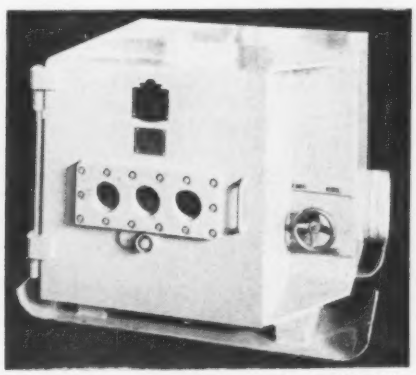
A working demonstration of the Elliot Automation "Optimat" system for controlling oil distillation columns. In the demonstration the distillation column is simulated by this Elliot simulator.

An industrial control system using d.c. transmission which is said to give complete stability on either electronic or pneumatic systems is shown by Fielden Electronics.



Tinsley's fully automatic hysteresis loop tester for iron and steel samples

Indicating temperature controller by Foster Instruments



Laurence, Scott flameproof recorder developed for the Coal Board

Assembly of Lucas high-power silicon rectifiers in controlled atmosphere

The Hivac "Access" system for fully automatic control of transfer machines in the motor industry has now been applied to production units. This is illustrated by a working model. The system uses cold cathode tubes, which have also recently been applied to touch-button control of lifts. For economical automatic control in the small factory the Gresham Lion Group have introduced a unit sequencing system, and Metrix Instruments are showing transistorised controllers for temperature and other variables.

Motor control systems are demonstrated by a number of exhibitors; for the small motor, Claude Lyons are showing a simple controller based on their well known Variac range and suitable for machines rated from 1/15 to ½ h.p. Accurate speed control up to high h.p. is possible by choosing a range of a.c. and d.c. industrial tachogenerators introduced by Laurence Scott for use with their Velonic control system.

An impressive application of semi-conductor devices to control is shown on the Westinghouse stand where versions of their silicon controlled Trinistor may be seen regulating theatre lighting loads. Industrial applications are represented by a 13 kVA regulator, a 5 kW controllable silicon rectifier and a 3 h.p. Trinistor motor starter.

PRINTED CIRCUITS AND STATIC SWITCHING

BOTH the application of printed circuits and static switching to industrial control and computing equipment is increasing rapidly. Printed Circuits Ltd. are showing "Plasmet" copper-edged circuits, strain gauges, and circuits for radio, television and industrial applications. Various grades of copper-faced Paxoline for printed wiring are displayed with the range of electric insulating materials shown by Micanite and Insulators. Aspects of printed circuits shown by Technograph, a firm specialising in this form of connection, include plated-through hole circuits, flexible printed circuits where bending or folding is necessary and flush-bonded circuits for all types of switching and commutation.

Plated-through and flush-bonded printed circuits in silver and rhodium plating are shown by the Telegraph Condenser Company, who are also showing their Flexistrip cable having a hair-thin copper tape conductor embedded in transparent polyester. For fixing wiring components to printed circuits, Belling and Lee have introduced a new "Prestincert" process and chemical cutting are showing single- and double-sided printed circuits and laminations in both ferrous and non ferrous metals.

Advantages of static switching control are featured on the AEI Electronics Apparatus Division stand where they are used to control a Capstan lathe. Design is based on the "nor" logic system.

The Brookhirst Igranic Bi-stat static switching system is also on view and is applied to inspecting, counting and allocating on multiple conveyors.

Transistorised static, logic and proximity switches developed by Bruce Peebles operate on the a.c. carrier principle and are suitable for industrial control schemes. A logic system employing transductor sensing elements applicable to industrial control schemes is shown by W. H. Sanders.

TELEMETRY

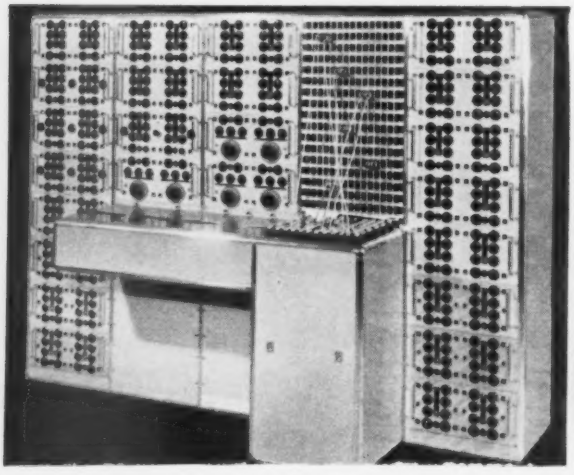
ABOUT a dozen companies are showing equipment for remote control, varying in complexity from the five telephone channels transmittable over one radio link developed by the AEI Telecommunications Division to the Telepulse data transmission system shown by R. B. Pullin for remote indication of storage tank level and temperature. Pullin are also showing their Crystal range of instruments and instrumentation equipment of Italian design. A feature of the Unibloc system, as it is named, is that all sensing elements give an output signal of the same form.

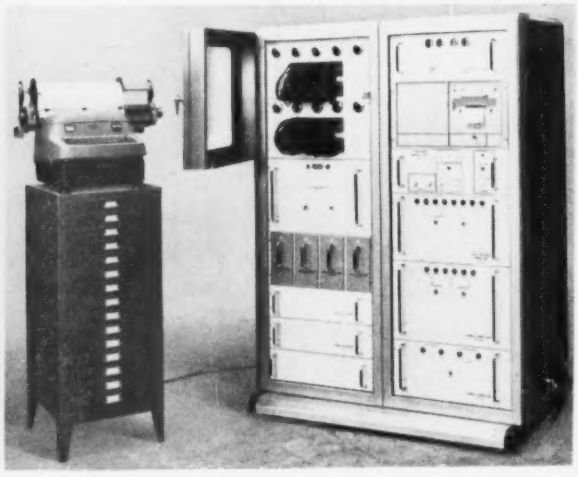
High speed signalling systems for transmitting information in binary form over normal telephone circuits are shown by Automatic Telephone and Electric Co. This equipment is fully transistorised and will transmit at 750 bands. An unusual development is the telemetering system of measurement for moving parts incorporating an encapsulated radio transmitter developed by DSIR and demonstrated on a diesel engine.

For the control of two speed motors at a distance, GEC are showing their Multiplex system which applies v.f. signals to a single telephone line. A remote indicating and recording system is also shown by Smiths.

Supervisory equipment by Evershed and Vignoles is illustrated by a working model of a 20 point system, and Telephone Mfg. Co. are showing a demonstration of telemetry equipment incorporating their relays.

F. C. Robinson's "TANA", their transformer analogue network analyser with, below, data logging equipment built up by Blackburn from their data handling modules





NOTES ON WIRING

BY MEGOHM

SOME time ago I commented on bathroom installations and thought that our ideas on them should be revised. Now I note that a well-known house planner has put forward an idea that the up-to-date bathroom should be designed to accommodate all the apparatus for washing and drying clothes. This includes a washing machine, spindryer and a drying or airing cupboard. The argument put forward for such planning is that the bathroom is normally designed to withstand condensation, is usually half-tiled at the least, and normally has the hot tanks sited close by. The fact that the planner considers it not very hygienic to wash clothes in the kitchen where food is normally prepared will probably be appreciated by many.

Altogether it seems a sensible idea to me although it may require much thought at the drawing stage and it is quite obvious that the lady of the house will not stand for any of her kitchen space being taken to make the bathroom larger. it will mean both a large kitchen *and* a large bathroom.

Naturally this arrangement would affect the electrical installation if it became general. It is correct to assume that the load will remain the same because the laundry apparatus is merely resited. Once it *has* been resited, the kitchen will probably gain something else in the way of electrical apparatus. There is also the matter of the wiring and controls for the apparatus to consider, and I doubt if the normal ceiling switch would suffice for this proposed miniature laundry.

It will be interesting to see if this idea catches on with other house planners or prospective house buyers and, if it does, just how much it will affect the electrical installation. I have noticed a question on this point in the evidence being collected by the official housing standards committee. Electrical organisations have shown that they dislike the idea of more equipment in the bathroom, largely from the standpoint of safety.

Trunking

One trunking installation looks very much like another and seldom do such installations rouse any interest. Recently I was speaking to a site operative and he invited me to examine the trunking he was erecting at the time, as it was a little out of the ordinary. An examination of the trunking and its components showed some unusual features, all of which were obviously designed to assist in making a neat job and to give easier handling on site. The trunking itself is so manufactured that the overlap of the lid fits flush with the side of the trunking. Thus the trunking can be installed close to beams or machinery without mutilating the edges. This is achieved by slightly setting the edge of the trunking. The connector pieces are provided with tapped holes in alignment with clearance holes in the trunking in order that earth links can be fitted at all connector places. In the back wall of the connector pieces there are tapped holes which allow screws to be driven in and exert a pressure on the joint and hold it in position. To make the matter quite clear, I would emphasise that the clearance holes mentioned previously are on each end on the standard length and should the trunking be cut the manufacturers claim that a sound joint can be achieved by the insertion of the screws in the tapped holes at the back of the trunking. There is no need to drill through the trunking at all. All that is required is the correct positioning of the connector piece within the two pieces of trunking to be joined together. I tried such a joint and found it quite rigid.

The other feature which shows the great amount of common sense which has gone into the planning of this trunking is the method of fixing the lid. This is done by small units which can be assembled on site, and all that is required is $\frac{5}{16}$ in. hole in the lid where the fixing is required. The unit is then assembled and is turned into place with either a coin or a screwdriver. I also like the manner in which the fixing unit held the lid in place. There was no suggestion of looseness at all in the joints which I examined.

Of course, trunking requires all manner of bends, entries, intersections and reducing pieces, and this firm issues a very useful data sheet showing all the available bends, etc. The 90° type fittings have special internal radiused corners to avoid dragging and cutting cables, an arrangement which I heartily approve of. I watched the site operatives erecting some of this trunking and gathered from their remarks that they found it easy to handle and the final arrangement met with all-round approval. The manufacturer does not, I understand, only make trunking but will supply any sheet steel cubicles or cabinets.

Pull Switches

My comments on pull switches has brought in one suggestion from a reader who suggests a flush switch unit sited at ceiling level and controlled by a cord which would be enclosed in a conduit so that only the end showed at normal switch level. Like my reader, I don't see why this couldn't be arranged, and I have, in fact, seen some ideas similar to it. I have also seen some attempts that were less successful. One hospital I know has an ordinary industrial type switch unit mounted on the ceiling with a short metal bar fixed across the dolly, and two lengths of cord hanging down, one on each end of the bar; the idea being that you pull one string for "on" and the other for "off." The electrician, I might add, was quite pleased with this contraption. Another arrangement of a "pull" switch I saw was in a bedroom for a young boy. A short piece of rubber tubing had been fitted to the dolly of the switch at the door and a string run through hooks to the side of the bed. A weight had been attached to the string above the rubber tube, and the idea was that when the light was required the string was pulled up, then the weight allowed to fall suddenly. The light was switched off by pulling the string and the weight allowed to drop gently until supported by the string. I do not, however, approve of either of these arrangements.

My reader also pointed out that the use of pull switches in bathrooms was an illustration of one IEE Regulation which has been strictly adhered to over the years. How very true, indeed. It is a pity that many more regulations were not treated so correctly.

400 kV in Sweden

DESIGN REQUIREMENTS LOWERED ON BASIS OF EXPERIENCE

SWEDEN has operated a 400 kV system since 1952. Since then, the original design of lines and associated equipment has been changed in many details, but in essentials the concept of transmission at this voltage has been proved. Development and performance experience were sketched for the IEE Supply Section in a lecture delivered last week by Mr G. Janke, of the Swedish State Power Board.

Sweden needs long-distance transmission because 85% of its energy sources lie in the north, while 85% of the population lives in the south. At present, an average power of 3,000 MW is being transmitted over an average distance of 400 miles. Within the next 20 years, the demand is expected to rise to between 8,000 and 10,000 MW, involving an average transmission distance of from 500 to 600 miles.

The first line at 400 kV was 600 miles long. There are now 2,000 miles of line spanning 900 miles of country, with 10,000 MVA of connected transformer capacity.

Design Factors

When the 400 kV system was first built, stability was an important limiting factor. Within limits so imposed, it was decided to use bundled conductors, two per phase of 1 sq in. copper equivalent s.c.a. Optimum capacity of a line of this kind is 600 MW. As the 400 kV system has been extended, stability considerations have become less pressing, and a change has been made to three conductors bundled together. The latest lines have conductors of 2 sq in. copper equivalent, and there is a possibility of 2·5 sq in. copper equivalent being used, giving a circuit capacity of 1,000 MW.

To assist in overcoming stability limitations, it was decided to install series capacitors. The capacitor stations are usually unattended and are visited only once a fortnight. Since the first went into service in 1954, there have been no electrical faults in such stations. Other steps to improve stability have included the use of generators and transformers with low reactance, and the use of fast-acting transductor-type voltage regulators. Three-pole high-speed reclosing is used on circuit-breakers, with good results, with 0·4 second dead time. With one line in circuit, single-pole reclosing becomes of interest as well. Symmetrical maximum short-circuit power at 400 kV busbars is 12,000 MVA at present.

In the early stages, when stability problems were pressing, it was important that interruption times should be low. Breakers were used with three-second break time in conjunction with relays operating in one cycle. Now that system stability is not so hard to achieve, more importance is being attached to mechanical stability of the protective gear.

Choice of insulation level for the 400 kV system had to take into account internal over-voltages as well as lightning induced over-voltages. As regards the latter, Sweden is in a moderate lightning zone, but earthing conditions are bad. The portal-type towers have two earth wires giving a 31° protective angle, and in addition, a continuous counterpoise cable is buried along the line route, except when the tower footing resistance of three or more consecutive towers is less than 30 ohms without the counterpoise. Only direct earthing of the transformer neutral is used.

Over-voltages and Insulation

Breaker operation is reckoned to give greater over-voltages than lightning, and insulation levels are based on these. Tests have shown that oil circuit-breakers result in much greater over-voltages when disconnecting an unloaded line than do air-blast circuit-breakers. The trouble is associated with restriking. Minor over-voltages are taken care of by surge diverters, which are connected to the transformers, not the lines.

Line insulation takes the form of cap and pin insulators, with a grading ring to improve voltage distribution. The line-end insulator takes 8% of the total voltage. The leakage path normally allowed in the clean Swedish atmosphere is $\frac{3}{4}$ in./kV, but this is increased to 1 in./kV when the lines run near the sea and are subject to salt deposits.

With increasing experience, the insulation level has been lowered continuously since the first lines were installed. In the future, it should be possible to work on a level of 1,300 kV, though it is thought wise to obtain more knowledge of the ageing of insulation before this is attempted. The general level used at present is 1,425 kV, compared with 1,775 kV in the first lines built.

It has not been thought necessary by the Swedish State Power Board to increase the cost of transformers by insisting on chopped-wave testing.

Operational Experience

With lines having double conductors 18 in. apart and 36 ft phase spacing, there has been insignificant trouble from radio interference. Still less trouble should be experienced in the new lines, because of the lower voltage stress at the surface of the larger conductors. Corona losses are estimated to be 1 kW/mile for fine weather, with an average value of 5 kW/mile of three-phase line. These losses are halved by the use of three conductors.

Because most of Sweden has a thin layer of soil over bedrock, earth faults may involve large voltages being induced in parallel lines—as much as 1,500 V in telephone lines. Surge diverters are installed in such lines, and in the worst cases the telephone circuits are underground. For l.v. power lines, isolating transformers are provided.

To facilitate starting up 400 kV lines, provision is made for a shunt reactor to be connected across the open end before energising the line. Such reactors are connected in 40 to 60 MVA units at the busbars of generating stations. At receiving stations, 400 MVAr of synchronous machines is available. In operating the system, voltage at the receiving end is allowed to fall to 380 kV at times of heavy load.

Protecting a.c. motor circuits

by J. L. Watts, A.M.I.E.E.

PART I: ESSENTIAL REQUIREMENTS

ALTHOUGH modern electric motors are reliable machines not likely to give trouble when correctly selected, connected and operated, the possibility of fire, danger to staff and damage to plant if they are subjected to adverse conditions necessitates the use of protective devices. These are usually designed to operate automatically once a prescribed situation has been created, as may be called for by various regulations, or where indicated by economic or other considerations, notably for protecting large and expensive, or key motors, machines controlled by unskilled operators or unattended motors responding automatically to the value of a certain parameter.

Whilst the situations in which protective gear may be required to operate will result from either mechanical or electrical malfunctioning, for convenience the protective gear is generally designed to monitor the electrical conditions and to operate by utilising the change in these conditions which the malfunctioning causes before they have time to damage the motor. It is thus a further requirement of protective gear that it should be capable of discriminating between normal and abnormal conditions. Under certain circumstances, moreover, it should also be capable of recognising that some abnormal conditions are only a transient phase of normal operation (such as starting) and require no protective action.

Under-voltage release

As is commonly known, the practical application of these general principles takes the form of devices measuring the motor current and supply voltage and cutting off the motor if the current rises above or the voltage falls below given values. The low-voltage sensing device has come to be a key component of both manually operated and automatic starters where the main current-carrying connection is made and/or maintained by means of a coil-energised electromagnetic system. This system is arranged to retain the main starter contacts in the closed position unless the supply voltage falls to about 85% of its declared value. At voltages below this level the under-voltage mechanism releases the main contacts and would not, in many cases, restart automatically when the supply was resumed. It is as well to emphasise here that where automatic re-starting is employed, appropriate precautions and warnings should be provided to avoid risk of injury to staff associated with such plant, in view of its liability to start at any time.

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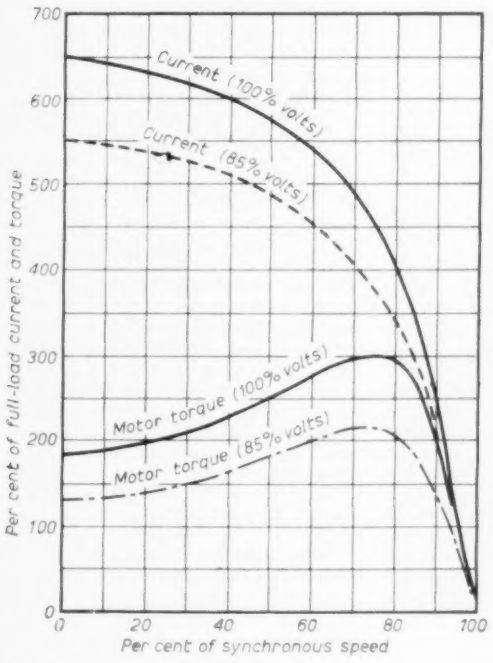

Fig. 1 (left). Effect of reduced voltage on the current and torque of a three-phase induction motor

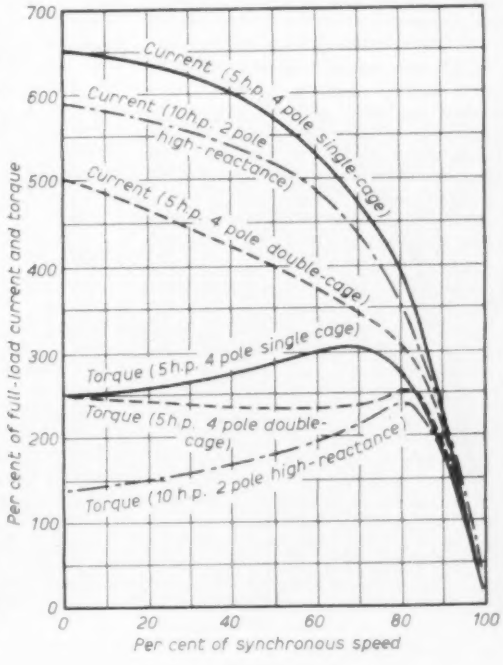

Fig. 2 (right). Characteristics of three-phase, squirrel-cage induction motors with different types of rotor when operated at standard voltage

400 kV in Sweden

DESIGN REQUIREMENTS LOWERED ON BASIS OF EXPERIENCE

SWEDEN has operated a 400 kV system since 1952. Since then, the original design of lines and associated equipment has been changed in many details, but in essentials the concept of transmission at this voltage has been proved. Development and performance experience were sketched for the IEE Supply Section in a lecture delivered last week by Mr G. Janke, of the Swedish State Power Board.

Sweden needs long-distance transmission because 85% of its energy sources lie in the north, while 85% of the population lives in the south. At present, an average power of 3,000 MW is being transmitted over an average distance of 400 miles. Within the next 20 years, the demand is expected to rise to between 8,000 and 10,000 MW, involving an average transmission distance of from 500 to 600 miles.

The first line at 400 kV was 600 miles long. There are now 2,000 miles of line spanning 900 miles of country, with 10,000 MVA of connected transformer capacity.

Design Factors

When the 400 kV system was first built, stability was an important limiting factor. Within limits so imposed, it was decided to use bundled conductors, two per phase of 1 sq in. copper equivalent s.c.a. Optimum capacity of a line of this kind is 600 MW. As the 400 kV system has been extended, stability considerations have become less pressing, and a change has been made to three conductors bundled together. The latest lines have conductors of 2 sq in. copper equivalent, and there is a possibility of 2·5 sq in. copper equivalent being used, giving a circuit capacity of 1,000 MW.

To assist in overcoming stability limitations, it was decided to install series capacitors. The capacitor stations are usually unattended and are visited only once a fortnight. Since the first went into service in 1954, there have been no electrical faults in such stations. Other steps to improve stability have included the use of generators and transformers with low reactance, and the use of fast-acting transductor-type voltage regulators. Three-pole high-speed reclosing is used on circuit-breakers, with good results, with 0·4 second dead time. With one line in circuit, single-pole reclosing becomes of interest as well. Symmetrical maximum short-circuit power at 400 kV busbars is 12,000 MVA at present.

In the early stages, when stability problems were pressing, it was important that interruption times should be low. Breakers were used with three-second break time in conjunction with relays operating in one cycle. Now that system stability is not so hard to achieve, more importance is being attached to mechanical stability of the protective gear.

Choice of insulation level for the 400 kV system had to take into account internal over-voltages as well as lightning induced over-voltages. As regards the latter, Sweden is in a moderate lightning zone, but earthing conditions are bad. The portal-type towers have two earth wires giving a 31° protective angle, and in addition, a continuous counterpoise cable is buried along the line route, except when the tower footing resistance of three or more consecutive towers is less than 30 ohms without the counterpoise. Only direct earthing of the transformer neutral is used.

Over-voltages and Insulation

Breaker operation is reckoned to give greater over-voltages than lightning, and insulation levels are based on these. Tests have shown that oil circuit-breakers result in much greater over-voltages when disconnecting an unloaded line than do air-blast circuit-breakers. The trouble is associated with restriking. Minor over-voltages are taken care of by surge diverters, which are connected to the transformers, not the lines.

Line insulation takes the form of cap and pin insulators, with a grading ring to improve voltage distribution. The line-end insulator takes 8% of the total voltage. The leakage path normally allowed in the clean Swedish atmosphere is $\frac{3}{4}$ in./kV, but this is increased to 1 in./kV when the lines run near the sea and are subject to salt deposits.

With increasing experience, the insulation level has been lowered continuously since the first lines were installed. In the future, it should be possible to work on a level of 1,300 kV, though it is thought wise to obtain more knowledge of the ageing of insulation before this is attempted. The general level used at present is 1,425 kV, compared with 1,775 kV in the first lines built.

It has not been thought necessary by the Swedish State Power Board to increase the cost of transformers by insisting on chopped-wave testing.

Operational Experience

With lines having double conductors 18 in. apart and 36 ft phase spacing, there has been insignificant trouble from radio interference. Still less trouble should be experienced in the new lines, because of the lower voltage stress at the surface of the larger conductors. Corona losses are estimated to be 1 kW/mile for fine weather, with an average value of 5 kW/mile of three-phase line. These losses are halved by the use of three conductors.

Because most of Sweden has a thin layer of soil over bedrock, earth faults may involve large voltages being induced in parallel lines—as much as 1,500 V in telephone lines. Surge diverters are installed in such lines, and in the worst cases the telephone circuits are underground. For l.v. power lines, isolating transformers are provided.

To facilitate starting up 400 kV lines, provision is made for a shunt reactor to be connected across the open end before energising the line. Such reactors are connected in 40 to 60 MVA units at the busbars of generating stations. At receiving stations, 400 MVAr of synchronous machines is available. In operating the system, voltage at the receiving end is allowed to fall to 380 kV at times of heavy load.

INDUSTRIAL ELECTRICITY

Protecting a.c. motor circuits

by J. L. Watts, A.M.I.E.E.

PART 1: ESSENTIAL REQUIREMENTS

ALTHOUGH modern electric motors are reliable machines not likely to give trouble when correctly selected, connected and operated, the possibility of fire, danger to staff and damage to plant if they are subjected to adverse conditions necessitates the use of protective devices. These are usually designed to operate automatically once a prescribed situation has been created, as may be called for by various regulations, or where indicated by economic or other considerations, notably for protecting large and expensive, or key motors, machines controlled by unskilled operators or unattended motors responding automatically to the value of a certain parameter.

Whilst the situations in which protective gear may be required to operate will result from either mechanical or electrical malfunctioning, for convenience the protective gear is generally designed to monitor the electrical conditions and to operate by utilising the change in these conditions which the malfunctioning causes before they have time to damage the motor. It is thus a further requirement of protective gear that it should be capable of discriminating between normal and abnormal conditions. Under certain circumstances, moreover, it should also be capable of recognising that some abnormal conditions are only a transient phase of normal operation (such as starting) and require no protective action.

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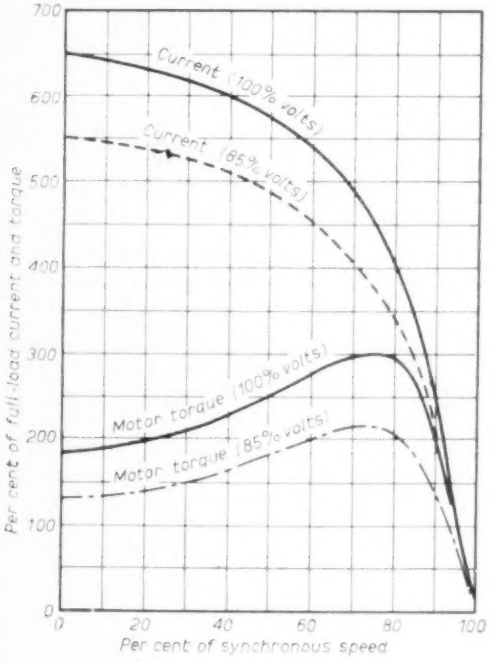


Fig. 1 (left). Effect of reduced voltage on the current and torque of a three-phase induction motor

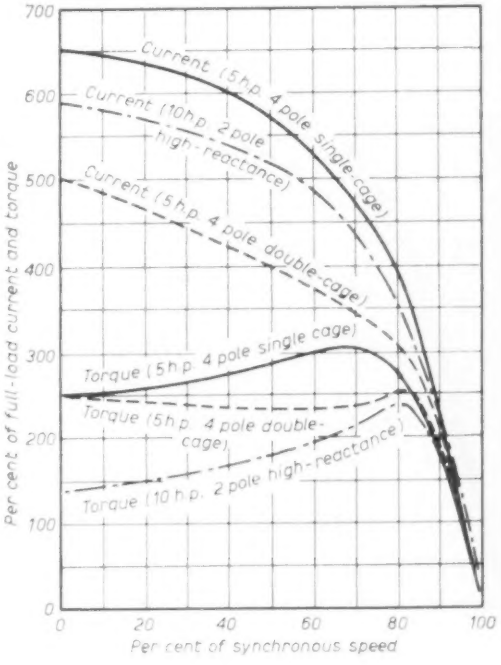


Fig. 2 (right). Characteristics of three-phase, squirrel-cage induction motors with different types of rotor when operated at standard voltage

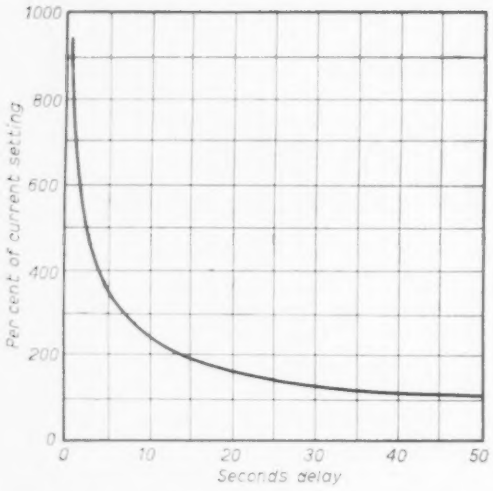


Fig. 3 (left). Time-current characteristics of a magnetic over-current with time lag

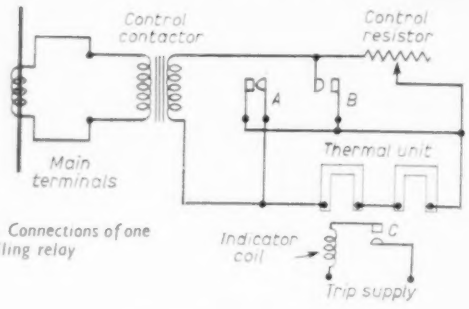


Fig. 4 (right, upper). Connections of one type of stalling relay

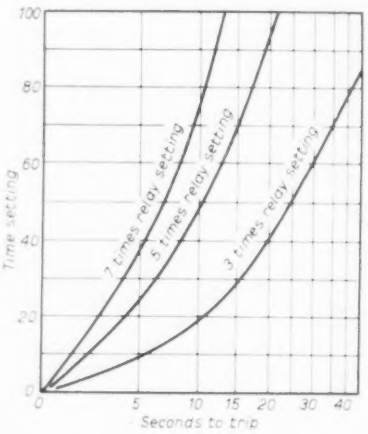


Fig. 5 (right, lower). Characteristics of stalling relay referred to above

rings, etc.) the coil circuit will not be closed and the motor will not be started. Similarly the circuit provides a convenient way of stopping the motor, either deliberately, by means of a push-button, or protectively, as the result of the operation of an overload mechanism.

Motor heating

Ultimately, most, if not all, abnormal conditions give rise to either gradual or sudden heating, and it is to prevent such heating from reaching the point of damaging the motor that the protection operates. It would seem, therefore, that protection would be afforded ideally by installing temperature-sensing elements at the danger spots in the motor, arranged to switch off the supply if the temperatures exceeded certain values. Apart from the practical difficulties and extra cost in the way of installing these devices, they would have to be virtually instantaneously acting to protect against conditions causing sudden heating.

Protection against heating due to excess current could be provided by a thermal overload element having the same thermal characteristics as the motor during heating and cooling, but there are difficulties with such devices also, chiefly resulting from the different ways a motor can react thermally to different kinds of abnormality.

These differences in thermal behaviour stem, of course, from the high resistance offered by the component materials of the motor to the flow of heat generated in the conductors. The thermal resistivity of sheet steel along the laminae may only be about eight times that of copper, but across the laminae it may be 20 to 40 times as much. The thermal resistivities of insulating materials such as mica, "Micanite," empire cloth and paper may be from 1,200 to 3,000 times that of copper, whilst those of dry cotton and still air are even higher. The thermal resistivity of the insulation limits the rate of flow of heat through it with a given temperature gradient across it, and thus delays the rise of temperature on the outside surfaces.

If there was no heat dissipation from a uniform conductor its rate of temperature-rise when carrying current would be proportional to the rate of heat production in the conductor, and inversely proportional to the heat capacity (weight × specific heat) of the conductor. However, heat is conducted through the insulation, so that the rate of temperature-rise of the conductor is actually proportional to: (I^2R − Rate of heat conduction, watts) ÷ Heat capacity of conductor. It follows that the conductor will be at a steady temperature only when the rate of heat conduction through the insulation is equal to the rate of heat generation in the conductor, the heat conduction being proportional to: Temperature gradient through the insulation ÷ Thermal resistivity of the insulation.

The ratings of c.m.r. motors are based on a "hot-spot" gradient of 10°C for class A insulation, 15°C for class B and class E insulation, with 25°C for class H insulation, under stable conditions on full load. However, the temperature of the conductors will continue to rise if the rate of heat generation exceeds the rate of heat conduction through the insulation, and there will then be an increased temperature gradient through the insulation, depending on its thermal resistivity.

Faulty starting

One of the most difficult heating problems is presented by a motor remaining stalled when switched on, or taking a long time to reach full speed. At starting most of the heating in a motor is due to the resistance of the conductors, and may be taken as approximately proportional to the square of the current. When started by d.o.l. switching the initial starting current may be six or seven times the full-load value, as shown by the typical motor curves in Fig. 2, in which case the initial rate of heating will be more than 35 times the full-load rate. If the motor does not accelerate rapidly to reduce this current the conductors will quickly reach a dangerously high temperature, without appreciably affecting the core temperature. Apart from obvious abnormalities likely to cause stalling, such as a faulty contact, low voltage, or mechanical overload, it is also necessary to ensure that the motor itself is the right type for the particular duty, since the starting torque depends on the design of the motor as well as on the method of starting. Fig. 2 shows that the ratio starting torque/full-load torque, as well as the ratio starting current/full-load current, may vary appreciably with different designs of cage rotor.

A further example is provided by comparing the performance of a continuous maximum rated (c.m.r.) motor to that of a continuous rated permitting overload (c.r.p.o.) motor, of the same size. The continuous rating of a c.m.r. motor may be about 115% of that of a c.r.p.o. motor of the same h.p. and speed, but the ratio of peak torque to full-load torque, and of starting torque to full-load torque of the c.m.r. motor will then be only about 87% of that of the c.r.p.o. motor. Hence a c.m.r. motor installed erroneously in place of a c.r.p.o. motor of the same horsepower rating may not be able to develop the required starting torque to reach full speed without overheating, or even to start at all.

Direct-on-line starting

Some guidance is given by BS 587, which requires that a d.o.l. starter be capable of starting a motor up to 600 h.p. in (3+h.p.) ÷ 10 sec, with a maximum of 15 sec, assuming the full-

voltage starting current at standstill does not exceed 8×f.l.c. for motors up to and including 100 h.p., and 6×f.l.c. for motors over 100 h.p. In the event of stalling or very slow starting the most rapid rate of heating of motor windings is likely to occur if the motor is started by d.o.l. starter. Protection against overheating of such a motor due to stalling or slow starting thus requires a device which will cut off the current if it fails to fall almost to full-load value in 3 to 15 secs after switching on, depending on the horse power and/or if the current remains at the stalled value for about half those times.

The time lag provided by many types of thermal overload release, especially when cold, may be too long to provide adequate protection against faulty d.o.l. starting under all conditions. However, a line-connected magnetic overload release with suitable time lag may provide the required protection, as indicated in Fig. 3. When a line-connected overload release is set to provide a certain measure of protection against faulty starting with a d.o.l. starter it may, however, give less protection, or may trip prematurely, if used with another type of starter, as will be explained later.

Special stalling relay

Where warranted by the circumstances it is often desirable to have stalling protection which is independent of the normal overload protection. One type of stalling relay, which is not intended for ordinary overload protection, incorporates a contactor with thermal unit, as in Fig. 4. The contactor coil is fed from a current transformer in the motor circuit, and controls both the normally closed contacts A and the normally open contacts B. These contacts are only operated during starting, or if the motor stalls while running, under which conditions the secondary coil on the contactor then feeds the thermal unit. The latter is automatically compensated for varying ambient temperature. In the event of the motor current then remaining at an unsafe value the thermal unit operates the contacts C to switch off the current and work the indicator. If the motor current falls to normal before the thermal unit operates C, the contacts A re-close to de-energise the thermal unit.

Fig. 5 shows the characteristics with one range of time settings. A relay can also be used with an additional contactor which allows one attempt to restart after the motor has stalled and been tripped out, the relay latching out if the motor stalls a second time.

(To be continued)

MAINTENANCE IN CORROSIVE CONDITIONS

Problems presented in manufacturing silicones

CHEMICAL works are commonly regarded as among the most difficult of industrial installations, from the electrical equipment aspect, in view of the corrosion and explosion problems they usually present. The work of keeping plant in service is frequently made more difficult by continuous operation of the process, so that careful programming of maintenance work is necessary to ensure that overhauls are properly carried out in the short times plant can be made available.

Such problems are presented in the manufacture of silicone products and some idea of the way they are dealt with was gained in a recent visit to the Barry works of Midland Silicones Ltd. Although the main purpose of the visit there was to inspect new research and development facilities, as reported in our issue of May 12, opportunity was also taken to consider the firm's practices in installing and maintaining electrical equipment.

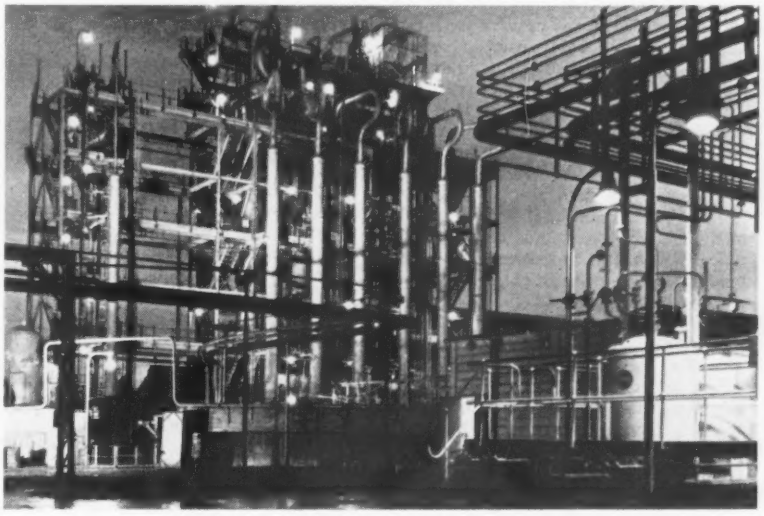
Corrosion Problem

Production of silicone products presents two main problems: corrosion and fire hazard. Corrosion is introduced by compounds generated as intermediate products in the process. These compounds, known as chlorosilanes, are readily vaporised, with the result that they are present in gaseous form in the production areas. They have a strong affinity for water and, in combining with the water vapour of the atmosphere, liberate hydrochloric acid and deposit a sand-like coating on exposed surfaces. The hydrochloric acid readily reacts with metal and the corrosive situation is aggravated by the moisture-retaining properties of the coating, which hold the acid in close contact with the surface on to which it has deposited.

Quite apart from this problem, virtually all the plant area presents an explosion hazard, which has meant that about 60% of all electrical plant is of flameproof construction. From the motor aspect, this difficulty is eased to some extent by most of the drives being for pumps, and having ratings from 5 to 10 h.p. In general, larger sizes of motor (up to 75 h.p. for rubber mills) are associated with processes which do not introduce an explosion risk.

Distribution Arrangements

Production of silicones at Barry dates from 1950 when the site was taken over from a Government-established factory originally set up to obtain minerals from sea water. The existing electrical distribution system has been applied with little change. It comprises main h.t. switchgear of Johnson and Phillips 150 MVA truck type o.c.b. units which has since been extended by one further unit. There is one main supply at 11 kV, originating at the Sully Moors substation of the South Wales Electricity Board, supplemented by two additional intakes capable of meeting an emergency load. Plans are in hand, however, to introduce a second main intake. The h.t. supply is transformed to 410 V via three transformers, of 1,200, 500 and 500 kVA capacity, respectively, at the main substation, and by a fourth, of 1,000 kVA, at a second substation fed from the main



The chlorosilane distillation unit at Midland Silicones works at Barry, seen at dusk. The lighting fittings shown are employed generally for hazardous areas in the works

switchboard. The transformers feed main m.v. switchboards of J and P draw-out o.c.b. units of 25 MVA and 30 MVA breaking capacity. This was also existing equipment, later extended to meet additional requirements.

Plant Switchrooms

Distribution around the site is in paper-lead cables to 14 plant switch rooms. Non-armoured cables are employed, buried direct in the ground, but the presence of acid requires a protective coating of p.v.c. sheathing. At the switchrooms, cables terminate in Reyrolle "HH" fused-switches which supply Bill "Majestic" fuse distribution boards. The usual arrangement is to install the "HH" switchboard in the centre of the switchroom, and to mount the distribution boards, together with starters and other control gear, on "Dexion" angle frames attached to the walls. In general, Donovan starters are used as standard, the features which the firm found most attractive, when designing the installation, being non-adjustable thermal overload relays and integral isolating switches which are capable of being locked off.

These switchrooms are brick-built structures with 9 in. walls and, apart from a ventilation grille, their only opening to atmosphere is a door which faces away from the production areas. With this arrangement, it has been possible to avoid the expense of flameproof construction for distribution and motor control gear, and thus facilitate its maintenance.

Local Circuits

To supply the plant, distribution from the switchrooms is carried out in m.i.c.s. cable, this being used for about 80% of all plant wiring and considered practical, economical, neat and safe. The cable is protected against corrosion by means of p.v.c. sheathing, which is sealed at terminations by a wrapping of p.v.c. tape over the glands. In certain cases, where long cable runs are required from switchrooms to the plant, the greater part of the distance is covered by means of p.v.c.t. wiring cables run in conduit installed in the open air, terminating at adaptor boxes, from which m.i.c.s. cables are taken into the plant.

In the production areas themselves, control of motor operation is effected by means of Allen West pushbutton stations, with flameproof enclosures. Motors are usually of Brook Motors' manufacture, for standardisation purposes. Again for convenience of stockholding and replacement, flameproof lighting fittings are of the Holophane make, of either reflector or well-glass types, these being considered most suitable for the firm's needs, particularly where dispersed lighting is required and the headroom available is not high. Lighting circuit switches are also generally standardised, being Simplex flameproof type.

Maintenance Programme

In all hazardous areas, electrical equipment, including cables where installed in cable tray or Dexion angle, are painted in orange-colour acid-resisting paint, a fresh coating being applied every six months and this has been found to give reasonable protection against the corrosive atmosphere. All motors and starters and associated equipment are inspected visually at least every month, checking temperature, noise and vibration and other factors. At about every six months, motors are taken out of service and examined internally for possible defects. This inspection interval, for most of the pumps in particular, is more usually determined by the life of the pump, since the corrosive nature of some of the liquids being handled results in a high rate of deterioration of the shaft sealing glands. The usual practice is to replace pump and motor as a complete unit, to which end, of course, the narrow range of motor sizes facilitates stockholding of replacement units.

For certain processes, electric heating is employed, applied in the external by means of elements wrapped round the heating vessel. These elements are enclosed, together with electrical connections, in robust steel cases and, since for this form of construction, flameproof enclosure is not feasible, the enclosures are purged with nitrogen to eliminate explosion hazards. The nitrogen is supplied at a pressure of 2 to 3 lb/sq in., its presence sensed by means of pressure switches arranged to cut off the supply to the heater on pressure failure.

As part of the plant, notably the fractional distillation of chlorosilanes, operates under continuous flow, appropriate automatic control equipment is employed. Regular inspection and overhaul of relays and other control devices is an important part of the electrical work, especially to avoid any deterioration of relay operation due to silica deposition on contacts.

Non-hazardous Areas

Outside hazardous areas, the practice has been to standardise on English Electric motors using totally enclosed, fan-cooled machines, or ventilated machines, according to site conditions. For smaller machines, the standardisation on Donovan starters and, where required, Allen West pushbutton stations, has been continued. For larger machines, various makes of control gear are employed, according to the requirements of the particular installation. As in hazardous areas, machines are subjected to monthly visual examination, and removed from service at from six months to two-year intervals.

Lighting in non-hazardous areas tends to be fluorescent wherever possible, fittings being mainly of Crompton Parkinson manufacture. Another difference from hazardous areas is seen in the wiring, for which conduit installations are generally adopted. Maintenance of the lighting installation, in both hazardous and non-hazardous areas, is carried out on relamping, when the fitting is cleaned. In hazardous areas, the aim is to establish a lighting level of 10 to 12 lm/sq ft, with non-hazardous areas having a somewhat higher levels, according to the nature of the production.

Electrical Staff

Under the control of the works electrical engineer, there is a staff of 19 in the electrical department, comprising supervisor, chargehand, nine electricians, six mates and two apprentices. Of this complement, two pairs of electrcian and mate are employed fully on maintenance, to carry out the monthly inspection. All major defects are reported by them for repair; minor defects are rectified by the four men as and when opportunity occurs. Apart from the monthly motor/starter inspection, the men also include daily visits to substations and weekly visits to switchrooms to check satisfactory conditions. Each electrician makes a report on the work carried out and conditions of plant as noted. Apart from the foregoing schedule, week-ends and shifts are allocated regularly to maintenance, as thought necessary by report, condition or period.

To support the inspection system, details are recorded of each motor and starter and any other plant item which requires an electrical service. The records system also makes provision for recording the full history of the item to which it refers.

Safety Procedures

Before carrying out work on site, a "permit-to-work" card is issued by the plant manager. The circuit is then isolated at the starter, the isolating switch being locked off. Keys for these padlocks are issued to the man carrying out the job who has to sign for their receipt and return. In this way, it is possible to ensure that there is no danger of an isolator being closed while work is being carried out on its associated motor or circuit. Two keys are held for each padlock; one, for normal day-to-day use, by the works electrical engineer; the other, for emergency use, by the work's police department. A similar arrangement exists for keys to switchrooms and substations. Operation of any main switch is carried out only by the electrical engineer or with his signed approval. A key diagram showing the positions of all main switches is retained in the electrical department. Where work to be undertaken in hazardous areas requires the use of spark- or flame-producing tools, it may only be carried out when an appropriate certificate has been issued.

Midland Silicones Ltd. is part of the Albright and Wilson Group and the engineering staff at Barry form part of the group's engineering division as a whole and were responsible for the design and installation of the electrical equipment at Barry. We wish to thank the works engineer, Mr. J. H. Fraser and the works electrical engineer, Mr J. Lilley, for assistance in the preparation of this article.

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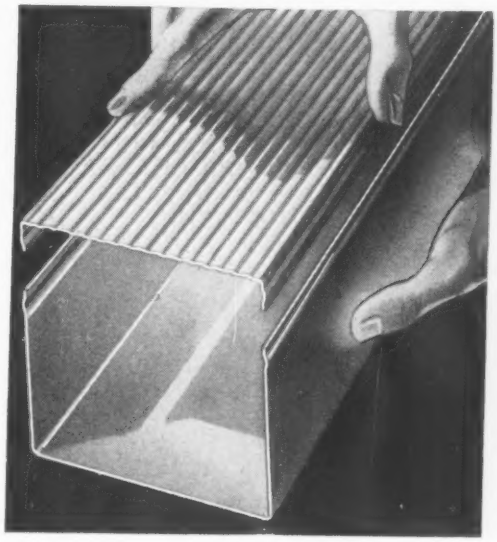

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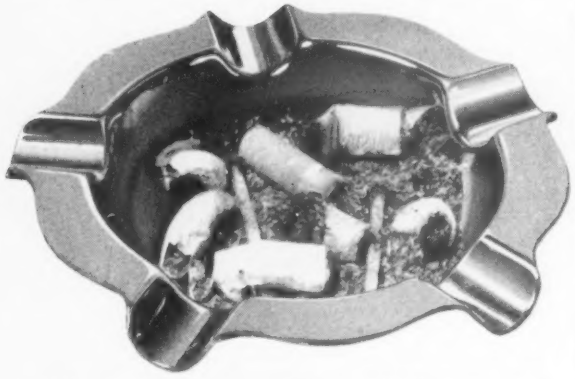

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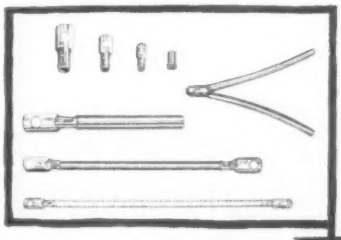

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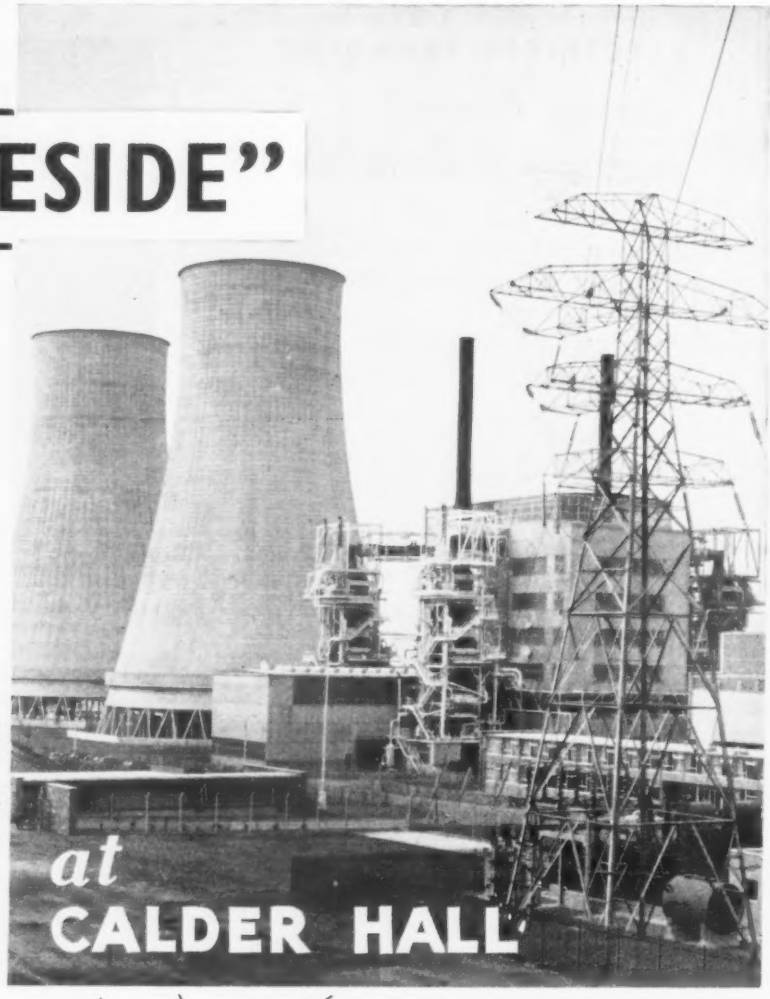
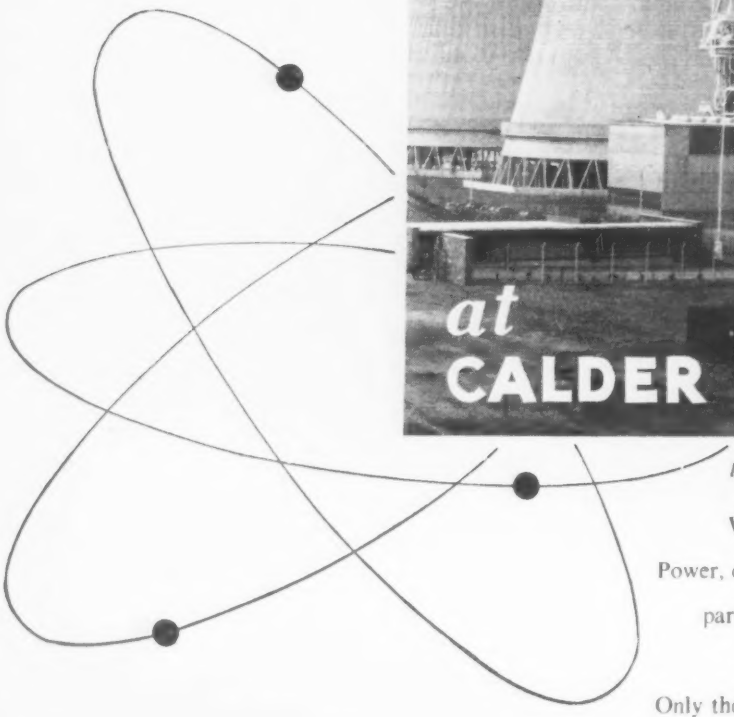


Photo by courtesy U.K. Atomic Energy Authority



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Brook Motors' LSD 50 Star-delta Starter

DATA SHEET 37

THE manually operated star-delta starter is one of the commonest types of control gear. It is fundamentally a simple piece of apparatus and most examples follow, to a great extent, a set pattern.

The starter illustrated is one of the recently introduced items in the Brook Motors' range of control gear and, as is to be expected, the general construction is quite simple as befits a mechanism of this type. It is a built-up job, that is to say, standard items, common to other kinds of control gear manufactured by Brook, are incorporated to make a functional whole, in contradistinction to so many control gears on the market which comprise elaborate mouldings and castings designed especially for the particular purpose for which it is to be applied.

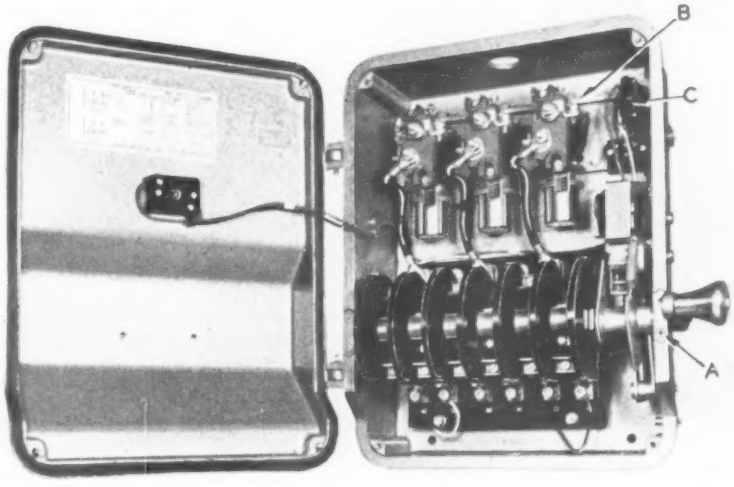


Fig. 1. General view of Brook Motors' LSD 50 star-delta starter. The items to which the letters refer are detailed in the text

General Construction

Considering its overall size, lightness is the first noticeable feature, achieved by the extensive use of light alloys, not only for the case but also for such parts as the dash-pots, piston and locking rings.

The gear is housed in a die-cast box with a hinged lid and the wide spongy grommet provided should certainly help to eliminate the intrusion of fine dust — a most important point in situations such as flour mills, cement block factories and the like. The cover carries the local "stop button" (not shown in the photo) and this has been covered with a rubber capsule for additional dust exclusion. Its prominent mushroom shape is a very good feature.

At the bottom of the case is the contact drum and the two sets of fixed contacts, which, as is so well known, effect a change in connection from star to delta. This contact drum is readily removable since it is only retained by a cap square with two Phillips' screws at each end of the spindle A, Fig. 1. When these cap squares are removed the drum can be withdrawn without disturbing the spring control or the retaining device which operates when the starter is in the "run" position.

The drum carries six pairs of contacts which are threaded into an insulated square shaft with moulded arc-resistant barriers between each pair. One set of contacts is shown in Fig. 2 which illustrates a portion of the shaft with its moulded insulation. The fixed contacts are also standard components which are bolted to a high-grade $\frac{1}{4}$ in. laminate phenolic panel. One fixed contact is shown in Fig. 3.

At the right side of the drum is the no-volt release (Fig. 1) which in this type of starter also acts as a retaining device to keep the contact drum in the "run" position. This n.v. release is a normal solenoid (Fig. 4) mounted on a die-cast bracket and attached to the side of the starter case. Two pins, 1, Fig. 4, are fixed at the end of the forked armature to engage the end of the drum locking catch, 2. The end of this catch carries a roller which engages a catch plate on the drum shaft.

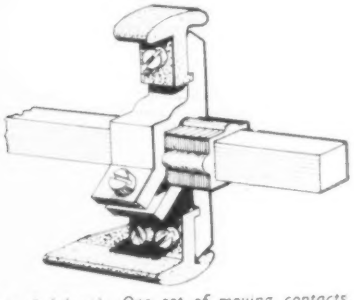


Fig. 2 (above). One set of moving contacts, showing its mounting shaft and moulded insulation

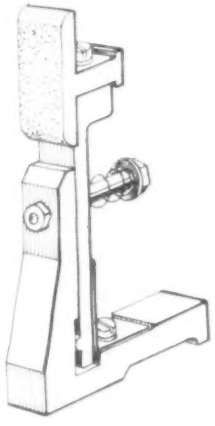


Fig. 3 (right). Arrangement of fixed contact

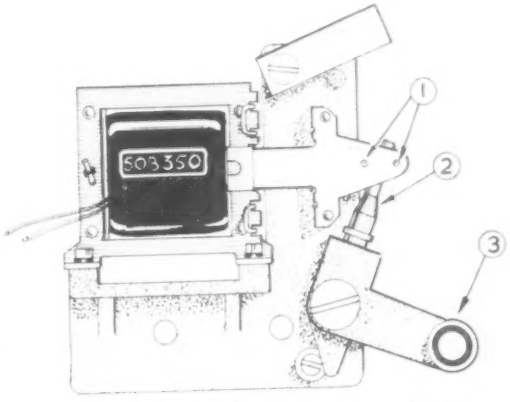


Fig. 4. No-volt solenoid and mechanical linkages

Overload Units

Magnetic dash-pot overloads are used with this starter and can be seen at the top of the photograph and in greater detail in Fig. 5. In their general design they are quite conventional. Each overload—there are three in conformity with normal English practice—is a self-contained unit mounted on a common steel backplate.

In the example illustrated the solenoid coils are wire wound and, following the modern technique, the ends of the wire are crimped to tags which are bolted to a ceramic terminal board. Immediately above the three overloads is a steel trip bar B, Fig. 1, which operates a standard auxiliary switch C, Fig. 1, in series with the n.v. coil.

Fig. 6 shows the piston assembly and Fig. 7 a section of the piston head with its valves. The dashpot piston is of double valve construction and is so designed that for line currents between 120% and approximately 200% full load both valves remain open, allowing the piston to move quickly through the fluid and to operate the trip bar. Above 200% full load current the force exerted on the piston is sufficiently strong to close the normally open spring-loaded valve 5, Fig. 6. This restricts the passage of the dash-pot fluid and thus assures that with heavy starting currents the time lag is sufficient to enable the motor to start and not trip the starter.

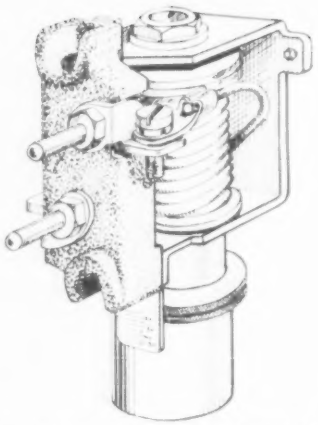
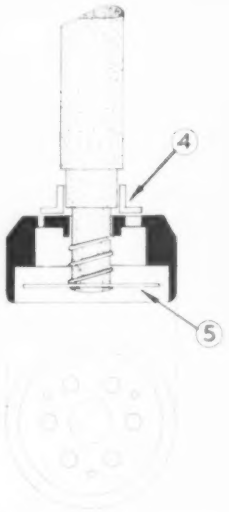


Fig. 5 (above). Detailed view of magnetic dash-pot

Fig. 6 (right). Dash-pot piston assembly

Fig. 7 (right). Detailed cross-section of head of dash-pot piston and plan view showing valve orifices



Tripping times in the order of one minute on 200% full load current, and 10 sec on 600% full load current are obtainable when the second valve has closed, whilst with 130% full load current the tripping time is still not greater than one minute, due to the second valve being open.

A silicone fluid is supplied for use in these dash-pots, so minimising the effects of change in viscosity due to temperature variations, thus giving more constant operating times than could be obtained with conventional oils.

The complete starter is a very straightforward article; its internal construction is obvious at the first inspection and it can be completely dismantled with ease. All these points are of value to the maintenance engineer whose work is diminished accordingly.

BACKGROUND TO LIGHTING DESIGN

EXPERIENCE has indicated what factors need to be taken into account when the lighting of industrial premises is under consideration; and even if specialist engineers are engaged to carry out the detailed design, the factory engineer needs to know what those factors are if he is to fulfil his role of intelligently critical customer. He will find notes designed to fit this purpose in a new publication* of the British Lighting Council, notes that by their comprehensiveness will probably encourage him to extend his own attempts at lighting design, and by their attractive presentation will provide him with useful ammunition if he is having a tussle to persuade management to spend more on lighting.

Factors in Lighting

Without introducing much in the way of radically new thinking, the handbook presents current ideas concisely, under three headings that cover the industrial field. First, it shows how the ability to work depends on ability to see; and how this in turn depends on matching the type and method of lighting to the particular characteristics of the material being processed. Secondly, it suggests in broad outline how lighting can assist in providing bright and cheerful surroundings, which can have an effect in terms of better factory housekeeping and a better health and safety record.

A third section of the handbook is a discussion of cost. This is notable for the standpoint it takes. The negative aspect of "unavoidable expenditure" is discarded for the more constructive approach: what can expenditure on lighting bring? The argument advanced is that it can bring increase in output, and reduction in spoilage and in labour turnover.

Fittings Maintenance

In the course of the discussion of the cost aspect of lighting, maintenance receives extended attention. The fundamental point taken is that to be effective, maintenance must be systematic. If maintenance is to be neglected for long periods, then to compensate for the decrease of efficiency of the installation with time, a much higher wattage must be installed initially.

There are three factors principally concerned in planning maintenance. First comes the ageing of lamps. There is little the user can do about this except replace lamps that have reached the end of their useful life, and ensure that the installation is planned on a basis of the quoted "average through life" output of the lamps used. A second factor is deterioration of decorations; some estimate of this effect must be made by those planning the lighting system, although it can only be approximate. The third factor is accumulation of dust and dirt on fittings. In deciding how much effort is worth while to deal with this, an estimate of rate of deterioration of light output is needed. The handbook suggests a method based on light meter surveys, assuming that over a period of not more than about three months, deterioration of light output due to dust and dirt takes place at a uniform rate. From the light levels immediately before and after cleaning, it is possible to calculate how much can be spent on maintenance to obtain the best compromise between such spending and the cost of "wasted" light occasioned by dirty lamps and fittings. This occurs when the cost of wasted energy is just equal to that of labour for the cleaning and related operations.

* Industrial Lighting, published by the British Lighting Council, 16 Lancaster Place, W.C.2, price 5s.

Surface breakdown of dielectrics

RESISTANCE TO SURFACE DISCHARGES DISCUSSED AT I.E.E.

IT is now almost universally accepted that the existence of a static discharge across the surface of an insulator under electric stress is a contributory factor to ultimate breakdown. That is to say, there is no such thing as a "harmless discharge." The ideal condition of a design in which surface electrical stresses are reduced to a point below the minimum discharge value is one that is not easy to attain, at least on an economic basis, but at low (i.e., power) frequencies the deterioration in many cases is so slow that some discharge is permissible without seriously affecting working life. The extent to which such discharges are permissible will depend upon a variety of conditions which may apply in service and also the nature of the insulating material itself. This, in turn, will depend upon the known behaviour of insulating materials under varying conditions of stress which can only be established by accelerated life tests of a type which have some relation to life under expected conditions. A number of investigators are working on the study of the subject and, in a paper* read before the Measurement and Control Section of the IEE in London last Thursday, Dr J. H. Mason, PH.D., A.M.I.E.E., described the progress which had been made to date in this particular field.

Factors Affecting Breakdown

No single factor is, of itself, the sole cause of breakdown. The voltage at which failure occurs will depend, in addition to the applied stress, on thickness of the material, amplitude, waveform and frequency of the applied voltage, temperature, humidity and nature of the ambient medium (oil, air, etc.) and other transient conditions. It follows that no single test can reproduce the behaviour of a material under all conditions of service and tests which are applied can only be considered as a basis of comparison between different insulating materials under comparable conditions and serve little value as design data.

Short duration electric strength tests, extensively used for proof testing in service, give little indication of the relative behaviour of materials in service because the stresses applied and the resultant surface discharges are far in excess of those to be expected in service. They frequently exceed the critical stress at which the surface discharge begins to penetrate below the surface of the insulating material. Tests on samples of sheet material are also usually done under oil to avoid flash-over and, in such conditions, breakdown is often the result of failure of the oil rather than of the insulation. In air, the creation of ozone or nitric acid and its condensation on the surface of the material can be a contributory factor through chemical action which gives no indication of imminent failure, and tests have shown that this is so by the higher values of breakdown which occur when a current of air is caused to flow across the surface to remove the gases and moisture as they form.

* Paper No. 3250: "The Resistance of Sheet Insulation to Surface Discharges."

Tests on Sheets and Laminates

For the tests described in the paper, electrode assemblies in the form of $\frac{1}{4}$ in. diameter stainless steel electrodes with flat ends and square edges are mounted vertically in a rig above, and in contact with, flat or curved sheets of insulating material. For the softer materials, a 75 micron gap is left between the electrode and the surface of the material to ensure that no mechanical damage is inflicted. The first group of tests was carried out on glass and paper laminates and sheets of polymers, the discharge inception stress being compared with the life at an applied voltage stress of 75 kV/cm 50 c/s. Thicknesses of the sheets varied from 1·1 to 1·6 mm and it is clearly shown that polymer sheet materials with a high discharge inception stress have the longest life. At the top of the list silicone rubbers, with a discharge inception stress of 20 kV/cm, show a life well in excess of 10,000 hours; at the bottom, the phenolic laminates, with a discharge inception stress of 9·7 to 10 kV, show lives well under 500 hr, both at 20°C. At 120°C the polymers show the same order of life but the phenolic laminates fail in 5-6 minutes.

Dealing next with glass laminates in which the bonding agents are silicone resin, epoxy resin, melamine and a polyester resin, respectively, comparative tests were carried out at 45 kV/cm and 65 kV/cm and, to accelerate the tests, frequencies and voltages above related service figures were adopted, but not so high as to affect the normal mechanism of failure. Again, a broad relation between discharge inception stress and life is established. The results of these tests show that silicone-glass laminates bonded with a high phenyl content resin have the greatest discharge resistance but, if the resin impregnation is poor and the resin crazes, discharges can penetrate the laminate at low stress without preliminary erosion. Epoxy bonded glass laminates show less difference in behaviour. Those hardened with an amine hardener show no erosion or physical deterioration in the presence of ozone or nitric oxides if previously aged for 100 hr at 120°C in air, but are badly affected if not aged. In subsequent experiments the so-called "anti-tracking" varnishes on phenolic bonded laminates had no significant effect on the discharge resistance either at 20° or 105°C, but a coat of an alkyd varnish showed a significant improvement at 105°C.

The paper goes on to describe other tests of a similar nature and, from these, suggests that, by using the simple electrode systems described in the manner laid down, a reproducible classification for discharge resistance of thin polymer films and laminates is possible of attainment. It is, however, evident that this is only an early phase in a wider research programme and that further researches, including tests with unidirectional pulse voltages to determine the effects of polarity on discharge resistance, are envisaged.

In the discussion on the paper, to be reported next week, particularly interesting contributions were made by Mde Fallou and M Lang who described methods for comparing resistance to surface discharges used in France.

OVERSEAS NEWS

from our correspondents abroad

CANADA

Inter-province Grid

The first of twin 300 ft high tension power line transmission towers ultimately designed to bridge the narrows of Halifax Harbour as part of the Nova Scotia section of the inter-provincial grid system is now about completed. The first of the towers is situated on a point of land just rear of the Shannon Park naval site, near where a 22 kV underwater cable now carries power across the harbour. The transmission lines for the inter-grid system will link up with the Nova Scotia Light and Power Co.'s Tufts Cove terminal and eventually with a proposed generating plant being considered for the area.

B.C. Railway Plan

Associated Electrical Industries Ltd. and the Cleveland Bridge and Engineering Co. are involved in plans for a northern railway project in British Columbia. This is an offshoot of the Wenner Gren British Columbia Development Co. who are pressing forward proposals for the Peace River power scheme, to undertake which additional railroads in that part of Northern Canada would be necessary. Also involved in the railway scheme are A. V. Roe (Canada) and Perini Ltd., of Toronto, a construction concern. The plan is to build and operate a 700-mile railway line.

COLOMBIA

Power Loan

A further loan for power development has been made to Colombia by the International Bank. A sum equivalent to $25 million is being made available jointly to the Corporación Autonoma Regional de Cauca (CVC) and the Central Hidro-electrica del Rio Anchicaya Ltda. (CHIDRAL), to be used to meet the foreign exchange requirements of a project to expand power facilities in the Cauca Valley, the total cost of which is estimated at $37 million. The project involves the installation of an additional 33 MW steam turbo-generator and boiler plant at the Yumbo power station, for completion by mid-1962, and the construction of the Calina hydro-electric scheme. This latter is to have two 30 MW sets with Francis-type turbines. It is also to erect some 154 km of 115 kV transmission line through the centra. part of the Cauca Valley and a further similar line 33 km long to link the Calina plant with the substation of Buga. Additional lower voltage lines are planned together with extension of distribution networks in Cali and other towns. Under the terms of the loan all the major items of equipment required are to be obtained through international tender.

JAMAICA

Wiring Inspections

Reflecting a large increase in building, both of houses and factories, inspections by the Jamaica Government's Electrical Division rose to a total of 13,912 last year, compared with 9,344 in 1957. Over the same period the number of points (sockets) compared to inspections rose from seven to one, to 11 to one. The fees charged by the electrical inspectors has been raised this year. A new training scheme for certified electricians has also been introduced. This involves a period of apprenticeship and the award of two types of certificates; one for general routine skill and the other for the former standard of skill.

NORWAY

Expansion Plans

Government plans for further expansion of the Tokke power development project and construction of new power transmission lines, to cost altogether 414 million kroner (£20·7 million), have been submitted to the Norwegian Storting. Fully developed, the four Tokke power stations will be able to produce about Kr. 3·7 billion kWh's annually. The Storting has also been asked to approve an agreement for power exchange with Sweden, to extend until 1 Jan., 1984. The Norwegian Government is anticipating obtaining a substantial loan from the World Bank to finance the new projects. Tokke 2 and Tokke 3 are estimated to cost 292 million kroner (£14.600.000) and the transmission lines will require 122 million kroner (£6.100.000). Under the Government bill, the two power stations would have a combined capacity of 410 MW. A later proposal will call for construction of Tokke 4, to have an installed capacity of 43 MW. The 400 MW Tokke 1, now nearing completion, will produce 2,130 million kWh's annually. Tokke 2 is rated to yield 920 million kWh's. Tokke 3 about 475 million kWh's, and Tokke 4 some 175 million kWh's. With the 45 million kWh's at Haukeli station, the combined output would be over 3·7 billion kWh's a year. The bill covers three 300 kV transmission lines, including one that would run from Tokke 1 in the Telemark province of East Norway, to Rogaland on the south west coast. The submarine network for transmitting power across the Oslo fjord would be enlarged from 4 to 6 cables, and a 380 kV line, with transformer station would be built from Skjeberg to the Swedish border. The latter project is intended for exchanging electricity between Norway and Sweden, as provided for in a draft agreement between the two State power authorities, subject to Parliamentary approval. The construction of Tokke 1, estimated to cost 490 million kroner (£24,500,000), is in part financed by a $25 million loan from the World Bank to Norway, extended in 1956. The large scale undertaking involves regulating and harnessing the Tokke and Vinje waterways. In July, 1959, the World Bank granted a loan of $20 million towards financing power projects elsewhere in Norway. These funds, made available to the Watercourse and Electricity Board, will be used to build two power plants, with a combined capacity of 168.000 kW's, at Tunnsjö and Tunnsjödal, in the province of North Tröndelag, and to erect 350 miles of transmission lines. The latter will connect power grids in central and southern Norway. About half of the one billion kWh's annually produced by the two power plants will be sold to the Swedish electricity grid. Meanwhile, another major power development project is nearing completion in the province of South Tröndelag. The first of three generators at the Upper Nea plant was recently started up, and before next autumn all three will be in full operation. Half the annual 600 million kWh production will be delivered to the city of Trondheim, with the remainder going to Sweden. Hegsetfoss power station, in Lower Nea, due to be ready in 1962, will export 200 million kWh's annually to Stockholm.

POLAND

Nuclear Postponement

Construction in Poland of the first nuclear power station for industrial purposes, previously scheduled for 1965, has been postponed until 1970. An analysis

of the possibilities and of the experience gained by other states has shown that this investment would not be profitable in the next few years, it is stated.

PAKISTAN

Further Investigation

An international consortium has been engaged by the Government of Pakistan to look into the feasibility of the proposal for electrification of the railways in West Pakistan, we understand. On the consortium are represented leading railroad firms of Western Germany, France, Switzerland and Belgium. A delegation sent by the consortium, it is understood, recently visited Pakistan, and held discussions with the railway and WAPDA authorities on the electrification proposal. The consortium delegation is to submit its report to the Railway Board, probably in July. The proposal for electrification of the NWR was made some months ago by the West Pakistan WAPDA. It is based on the assessment that shortly there will be a surplus of power in West Pakistan, and that operating costs would be lower. But the Railway Board are moving cautiously in the matter. They originally invited a Japanese firm, which undertook electrification of railways in that country, to examine the proposal. The result of that firm's examination is with the Railway Board in the form of a report. Its contents have not been revealed, and it is suggested that the Railway Board was not fully satisfied with the Japanese firm's examination of the proposal. They therefore decided to entrust the proposal for further examination to the consortium, which has electrified certain railway routes in India and the entire railway system of Belgium.

Power Talks

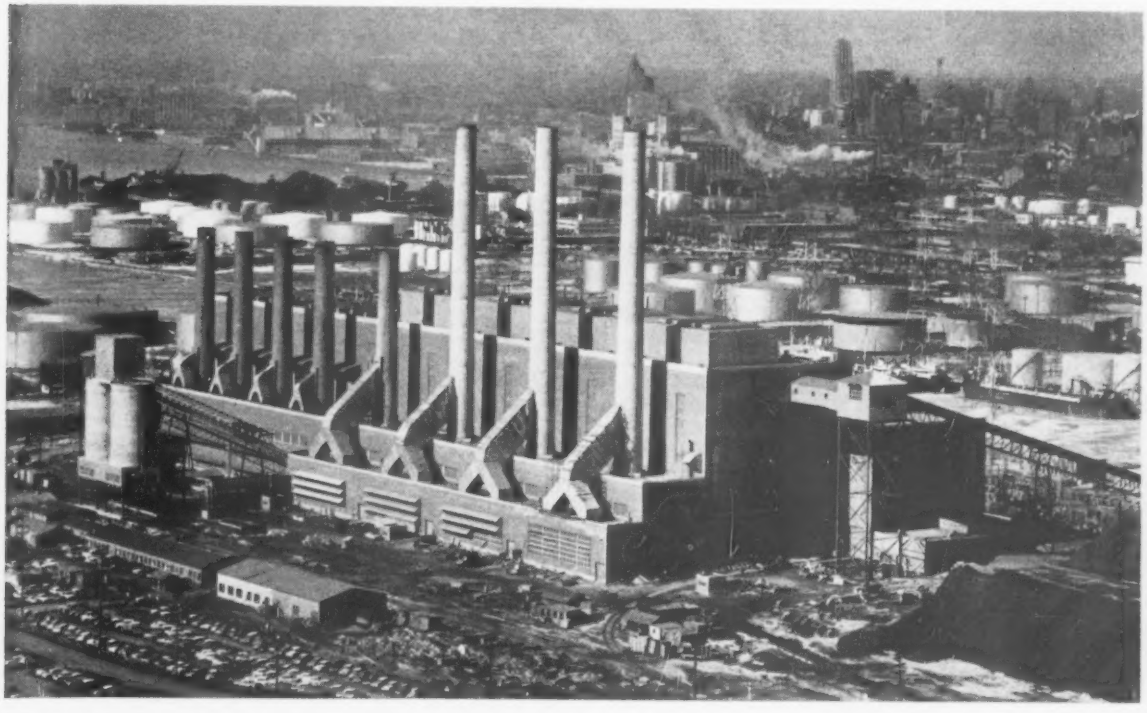
Negotiations are expected to take place this month on a request from India for a supply of electricity from the Karnaphuli dam, in Pakistan. Mr Nazir Ahmad, secretary of the Pakistan Ministry of Works, also revealed that India had indicated interest in Pakistan's natural gas supplies.

AUSTRALIA

Snowy Finances

Over 186 million units were generated by the two power stations of the Snowy Mountains Hydro Electric Authority during the year ended 30 June last. Average cost p.u. was 0·9785d. The first station to operate, Guthega, contributed over 157·6 million units, the cost of this predominantly peak load energy being 1·0199d p.u.s.o. The other station, Tumut I, only started up a year ago and generated 30·4 million units, but additional sets have since been installed there. The annual report of the Snowy Mountains Authority states that the total net capital expenditure to 30 June last on permanent works was £134,326,144, of which £13,114,959 related to the Guthega project which began operating in February, 1955, and £9 million for the 160 MW first phase of Tumut I. It is anticipated that the cost of peak load energy from the latter station when in full production will be about 0·90d p.u. The corresponding figure for the combined output of Tumut I and II is estimated at 0·95d p.u. Interconnection with the systems of New South Wales and Victoria has already been achieved with 330 kV lines, and further such transmission routes have been surveyed. As we noted on 5 May, it is now proposed to modify the Snowy-Murray development with tunnels at higher levels than originally planned, making it possible to utilise Snowy River water for power and irrigation at least two years earlier. Under the plan, water would be pumped from Jindabyne reservoir to the tunnel system near Island Bend during the night and week-ends. The water would then be diverted to the Geehi reservoir for peak load energy production in the Western power stations. Reference is also made in the report to the increasing cost of road maintenance due to use of the authority's road system by tourists. It is unfortunate that the authority is not able to collect some revenue from the general public using these roads to offset the maintenance costs, it is added.

With Canada's largest thermal-electric plant dominating the foreground, our picture below graphically illustrates Toronto's ever-growing industrial stature. The power plant—Ontario Hydro's Richard L. Hearn station—is to be larger still. Initially four 100 MW Parsons sets were installed, and, for the extension, four 200 MW machines were also ordered from C. A. Parsons. The first of these began operating last year, and the remainder are scheduled for service this year. The Hearn plant will then have an aggregate capacity of 1,200 MW. Chimneys for the first five units are 200 ft high and those for the final three are 300 ft high—King size! Located on Toronto's waterfront, the Richard L. Hearn station was officially opened in 1951



Personalities *in the industry*

Dr P. R. Howard

Mr D. F. Oakeshott

Mr H. W. Povey

Mr G. A. Rendle

Mr S. W. Eckett

Mr H. J. H. Nethersole, general manager of the English Electric Co.'s Traction Department, has been appointed a director of two member companies of the English Electric group—Vulcan Foundry Ltd. and Robert Stephenson and Hawthorns Ltd.

Dr P. R. Howard, PH.D., B.SC.(ENG.), A.M.I.E.E., has been nominated head of the High Voltage Laboratories at the Central Electricity Research Laboratories, Leatherhead. He will be assisted by **Mr D. F. Oakeshott,** B.SC., A.INST.P., M.I.E.E., who has been designated deputy head. (*ESH, page 48-9.) The CEGB's high voltage laboratories are at present being reconstructed and extended, and investigations have been carried on recently at the h.v. laboratories of the NPL. Dr Howard's responsibilities will range widely over investigations into transmission and switching problems with the exception only of direct current. Dr Howard entered the Government service in 1942 when he became a scientific officer in charge of the Electrical and Instrumentation Section of the Airborne Forces Experimental Establishment. Following the reconstruction of the Scientific Civil Service in 1947 he joined the staff of the High Voltage Laboratory at the National Physical Laboratories and subsequently became a principal scientific officer. He left in 1958 to join the Applications Branch of the Research and Development Department of the CEGB as head of the Transmission Systems Section. He now leaves this post to take up his new duties at Leatherhead. Mr Oakeshott joined the Electricity Division of the National Physical Laboratories in 1936 after a year as a student-employee with the Research Association of British Rubber Manufacturers. From 1941 he worked in the High Voltage Laboratory of the NPL. He left to become senior scientific officer in charge of surge research with British Insulated Callender's Cables in 1946. Two years later he joined the staff of the then British Electricity Authority as a senior assistant engineer at the Research Laboratories, Leatherhead, and in 1955 he was appointed head of the Transmission and Distribution Section. He relinquishes this post to take up his new duties as deputy head of the High Voltage Laboratories.

Mr H. E. R. Shand, C.A., has been appointed to the board of Mullard Ltd. Prior to joining Mullard Ltd., Mr Shand was for some years comptroller to the David Brown Corporation Ltd., and before that chief accountant to Metal Industries Ltd.

Following the appointment of **Mr H. W. Povey,** O.B.E., as a full-time member of the Uganda Electricity Board, the board announce the following changes: **Mr W. W. Duff** becomes accountant and registrar (he was formerly deputy chief accountant); and **Mr H. S. Smith** becomes deputy accountant and registrar (he was formerly senior cost accountant). Mr Povey, previously chief accountant and now an executive director of the board with wider responsibilities, will continue to be in charge of the board's overall finances. Mr Povey joined the board as chief accountant in 1948, and earlier, was accountant for No. 4 sub-area of the Merseyside and North Wales Electricity Board. He was awarded the O.B.E. in 1954 at the time of the official opening of the Owen Falls scheme by HM the Queen.

British Insulated Callender's Construction Co. Ltd. announce the retirement of **Mr G. A. Rendle,** B.SC., M.I.E.E., who has been deputy general manager since August, 1958. Mr Rendle has been associated with the BICC Group for a considerable period, having joined Callender's Cable and Construction Co. Ltd. in 1920 as a contract engineer. From 1920 to 1925 he was engaged on telephone and power cable contracts, principally in London and Scotland. He then took charge of the construction of underground and overhead electricity supply systems in the Weald of Kent, Herne Bay and Dublin. In 1930 he was posted to Buenos Aires to carry out a cable contract for the Central Argentine Railway. On returning to the UK in 1932 he became resident engineer in charge of the first contracts for the Dumfries County Council rural electrification scheme. In 1937 he was appointed resident engineer in Nottingham. Following the formation of British Insulated Callender's Cables Ltd. he became deputy cable contracts manager in 1946 and in 1949 was appointed cable contracts manager of British Insulated Callender's Construction Co. Ltd., and in 1954 director and manager, cable contracts, in which capacity he continued to act following his appointment four years later as deputy general manager.

Mr S. W. Eckett, B.SC.(ENG.), A.M.I.E.E., has been appointed chief engineer of Nalder Bros. and Thompson Ltd. Mr Eckett studied engineering at West Ham College of Technology and his past experience includes a number of years in the Chief Mechanical and Electrical Engineer's Department of British Railways (E. and N.S. Regions). He joined Nalder Bros. and Thompson Ltd., in 1951 as research and development engineer, since when he has represented the company on both BSI and BEAMA technical committees. He has been responsible for a number of developments, including monitored earth leakage devices and electrostatic voltmeters.

Sir Anthony Miers, V.C., K.B.E., C.B., D.S.O., **Mr Simon Kale** and **Mr Jack Grant** have been elected to the board of Francis Sumner (Holdings) Ltd.

Hadley Telephone and Sound Systems Ltd. have promoted **Mr S. B. Gibson** to the new post of technical field engineer. Mr Gibson has been with the company for 20 years, latterly as service manager.

Mr A. G. Brown has been appointed a lighting engineer with the South East Region of Philips Electrical Ltd. Mr Brown, who is a diploma member of the Illuminating Engineering Society, saw previous service with Philips as a

** Denotes revision to the "Electricity Supply Handbook, 1960."*

sales engineer with the South East Region from 1957-58. Since that time he has held an appointment in Nigeria and has recently returned from that country.

As we briefly reported last week, **Mr T. J. Rowlands,** B.SC., A.M.I.E.E., has been appointed chief engineer and manager of the Engineering Department of George Ellison Ltd. Educated at Towyn Grammar School, Mr Rowlands later obtained a First Class Honours degree in Electrical Engineering at the University College of North Wales, Bangor. During the second world war he was commissioned in the Technical Branch of the RAF. After service with the Merseyside and North Wales Electricity Board as assistant operations engineer, Mr Rowlands joined the English Electric Co. Ltd. in 1949 as circuit-breaker design engineer. In 1953 he was transferred to the Rectifier Division, where he was concerned with design and protection problems of large rectifier plant. In 1958 Mr Rowlands was appointed chief engineer and manager of the Switchgear Division of Lancashire Dynamo Nevelin Ltd., his responsibilities later including the Rectifier Division of that company.

Mr George Ellison, jnr., has been elected to the boards of directors of the associated companies, George Ellison Ltd., Alfred Ellison Ltd. and Tufnol Ltd. Mr Ellison is the grandson of the late Mr George Ellison, the founder of all three companies.

Mr Allen L. Stock, chairman of the Morgan Crucible Co. Ltd., and the Ship Carbon Co. of Great Britain, has been re-elected chairman of the London Chamber of Commerce.

Mr J. E. Price, A.M.I.E.E., of Lancashire Dynamo and Crypto Ltd., and a director of Malcolm and Allan (London) Ltd., has been elected a vice-president of the Association of Lancastrians in London. He had previously held the office of chairman for 13 years.

Mr G. J. Gaunt, sales manager of the Reliance Telephone Co. Ltd., has been appointed a director of the company. He has also joined the board of the Telephone Supplies Ltd., an associate company. Both companies are subsidiaries of the General Electric Co. Ltd. **Mr W. T. Ashton,** A.M.I.E.E., has retired as a director of Reliance Telephone Co. and Telephone Supplies after more than 40 years' service with the companies. The assistant manager of the Reliance Telephone Co., Scottish area, **Mr R. V. Doyle,** has been appointed manager of the area in place of **Mr H. J. McCusker,** who has retired.

Mr C. L. Lipman, right, chief technical engineer of Nalder Bros. and Thompson Ltd for 42 years, receives the presentation from Mr E. W. Semmens, managing director, on his retirement

After 43 years' service with Nalder Bros. and Thompson Ltd., **Mr C. L. Lipman,** M.I.E.E., chief technical engineer, retired recently. In our photograph, above, Mr Lipman is seen receiving a retirement gift from the company in the form of a 21 in. TV and radio receiver from the managing director, **Mr E. W. Semmens,** who also presented him with a gold wrist watch from friends and colleagues at Nalders. Mr Lipman came to this country in 1917 from Liege University and continued his education at King's College and London University, becoming chief technical engineer at Nalders in 1918. He has served on many BEAMA and BSI technical committees and in 1944 was awarded the IEE Mather Premium. During his service with Nalders, Mr Lipman developed numerous patents which are now known throughout the world, such as power factor indicators, frequency meters, synchroscopes and protective relays, and was the original patentee of the now widely used centre magnet moving coil instrument.

Mr J. R. Davies has joined Crompton Parkinson (Stud Welding) Ltd. as sales manager, in succession to **Mr R. W. Taylor.** Mr Davies goes to his new post from Expert Heat Treatments Ltd., where he was sales director. He was previously, for seven years, chief sales engineer in Cooper and Turner Ltd., of Sheffield, makers of welding electrodes. He entered the welding industry soon after the war through Lincoln Electric Co. Ltd., who were formerly associated with the sale and service of Nelson stud-welding equipment in this country.

Mr A. N. Langworthy, Philips' lamp and lighting representative in the Bedfordshire, Cambridgeshire and Huntingdonshire area, retired recently after 37 years' service with the company.

Emitrade—the Export Division of Electric and Musical Industries—has now become the Export Division of the reorganised Gramophone Co., with **Mr Kenneth Moore** as general export manager. Mr Moore has been manager of the Emitrade Export Division since 1954. He first joined the EMI group as export sales manager of Electronic Tubes Ltd. in 1962. Previous world marketing activities of Emitrade Export will in future be controlled by the new division in addition to the overseas distribution of the Gramophone Co.'s range of domestic electrical products and sound reproducing equipment.

Mr A. H. Freeman, A.M.I.MECH.E., A.M.I.C.E., has been elected chairman and managing director of Heatrae Ltd. Mr Freeman has served for the past 14 years as deputy to the late Mr C. H. Smith, who was a founder of the business and, at the time of his recent death, was chairman and managing director.

Mr G. Goodger has joined Bulpitt and Sons Ltd. as assistant representative to Mr E. L. Pain, covering the South and South East territory. He was previously senior showroom assistant with the South

Mr T. J. Rowlands

Mr G. Ellison, jnr.

Mr G. J. Gaunt

Mr W. T. Ashton

Mr R. V. Doyle

Mr F. B. Manning

Mr J. H. Barham

Mr N. E. Wilkinson

Eastern Electricity Board at Purley.

At present on the headquarters staff of the Eastern Electricity Board, **Mr F. B. Manning** has been appointed secretarial officer to the board's Chilterns subarea, in succession to **Mr F. G. Page,** A.I.A.C., who is retiring. (*ESH, page 106.) A Lincolnshire man, Frank Manning has been associated with electricity supply for most of his working life. At Peterborough, where he worked for the municipal authority, he was the clerk to the electricity committee and later transferred to Luton Corporation in a similar capacity. He joined the Eastern Electricity Board in 1949 as the principal assistant to **Mr L. A. Jackson,** who is now the deputy secretary; in 1958 he became a member of the establishments staff and more recently was on secondment to Norfolk sub-area as a member of the secretarial officer's staff. Mr Manning recently attended a Communications in Industry course and management course sponsored by the Electricity Council.

Mr J. H. Barham has been appointed Birmingham area representative for Chilton Electric Products Ltd. covering Shropshire and Staffordshire (as far north as, and including, Shrewsbury, Wellington and Stafford) to the borders of Staffordshire and Derbyshire and including Warwickshire, Worcestershire, Herefordshire, Monmouthshire, Glamorganshire, Carmarthenshire and also Gloucestershire. Previously he was rep. for Telcon.

Formerly with Atlas Lighting Division of Thorn Electrical Industries Ltd., **Mr N. E. Wilkinson** has joined Nettle Accessories Ltd., to be responsible for further development of their Industrial Division. He served an apprenticeship with Manchester Corporation Electricity Department before serving in the RAF from 1939 to 1946. Subsequently he was with Frigidaire Ltd. for two years.

Mr G. L. Greaves, A.C.I.S., M.B.I.M., has been appointed assistant secretary (personnel) of the Yorkshire Electricity Board in succession to **Mr H. E. A. Donnelly,** M.C., T.D., A.M.B.I.M. Mr Greaves has been in the electricity supply industry for 27 years, including pre-nationalisation appointments with municipal undertakings, and is at present establishments officer with the North West, Merseyside and North Wales Region of the CEGB. (*ESH, pages 73/141.)

Mr Harold Doust, A.M.I.E.E., will be retiring from the service of the Yorkshire Electricity Board on 6 June, after 46 years in the Industry. Mr Doust commenced with the Grimsby Corporation in 1914 and became district engineer. In 1931 he joined the Louth Corporation as engineer and manager of the Electricity Department and in May, 1948, was appointed manager of the board's Gainsborough district, from which position he now retires. Mr Doust will be succeeded by **Mr E. H. Jubb,** A.M.I.E.E., who is at present senior assistant engineer (commercial) in the board's Grimsby sub-area. (*ESH, page 147.)

NEW LITERATURE

Year Book of the Heating and Ventilating Industry

THE backbone of this Year Book is, as usual, a list of the trade's more important agreements for employment and for trading, and an extensive buyer's guide. Also included are a number of technical articles of topical interest. Mr L. G. Fischer discusses considerations in heating and ventilating design that affect choice of sizes for pipes and ducts, and Dr C. N. Davies suggests a scientific basis of heating design for large poultry houses. Warm air heating for domestic and commercial buildings is a subject of another article by Dr W. Davidson. Amongst other contents is an index to heating and ventilating literature published in 1958. Also included is a selected list of British Standards. Published by Technitrade Journals Ltd., 464 pages, 8¼ in. by 5¼ in. Thirteenth edition, price 16s 6d.

Basic Audio. Vols 1, 2 & 3

by N. H. Crowhurst

THE author states in his preface that these three books are suitable for the practical man who, lacking academic background, finds it difficult to grasp technical literature which he reads with only "intuitive comprehension." If the reader understands this phrase and can interpret Americanisms such as "finagling" which appear from time to time in the text he may well find this a useful introduction to audio techniques. The book covers most aspects of audio practice from acoustics to impedance matching and stereophony. However, the treatment is essentially elementary and about half of each book is devoted to line illustrations which make great use of modern visual aid techniques. Equations, for example, are represented by cartoon-like diagrams. Whether these really present a clearer picture to the reader than a conventionally laid-out book is doubtful. Published by Chapman and Hall; 9 in. by 6 in.; Vol. 1, 114 pages; Vol. 2, 122 pages; Vol. 3, 113 pages. Price 23s each.

Electrical Trades' Directory, 1960

ALL who have regularly used the annual Blue Book will welcome the appearance of the 1960 edition, for it brings up to date again the vast array of information on the electrical industry. It conforms to the same pattern of its predecessors, with eleven sections covering manufacturers, merchants, contractors, wholesalers, engineers, products and trade names, etc. Apart from the alphabetical list of firms, probably the most valuable section is the classified list of suppliers of various equipment which has been extended still further and now occupies over 1,100 pages. A general index, placed at the rear this time, provides rapid reference to any firm named in this invaluable directory. Published by Benn Brothers. 1,700 pages. 9 in. by 6 in. Price 63s.

OBITUARY

Mr P. J. Fell, A.M.I.E.E., East Midlands area manager of A. Reyrolle and Co. Ltd., died on 8 May, aged 44. Mr Fell was educated at Faraday House and joined Reyrolle's technical research staff in 1937 as a student apprentice. Following service in the Navy he returned to Hebburn as a contracts engineer, and served as a district engineer in the Company's Manchester and Leeds offices between 1952 and 1956.

Mr C. C. Cockbain, sales manager and engineer with Bullers Ltd., died on 8 May, aged 65. He joined the company in 1912 and was closely connected with the early developments of h.v. overhead transmission.

Mr F. L. Smith, area electrical engineer for the No. 6 area of the Durham Divisional Coal Board, has died, aged 58.

With the death on 12 May of **Mr T. L. Horn,** M.I.E.E., at the age of 90, a link with the early days of electric tramways in London has been severed. Mr Horn was divisional electrical engineer in the Tramways Department of the former London Passenger Transport Board, from which position he retired in 1935. He first became associated with the LCC Tramways as the representative of Siemens Bros., to whom was entrusted the installation of the original h.t. cables. Later he was appointed distribution engineer to the undertaking.

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Conduit Continuity

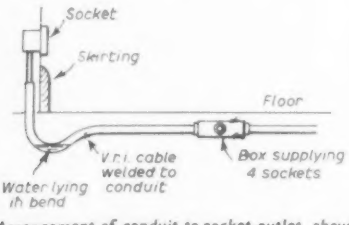
ONE can extend the greatest sympathy to Mr Dearden (28 April issue) in his criticism of "slap-dash" work, but when he states that this is carried out by well-known firms the reader can be forgiven for wondering what the National Inspection Council for Electrical Installation Contracting is doing about it. This august body appears to be very energetic in crawling along lofts to observe whether ceiling outlets are fully protected to conform with the requirements of IEE Reg. 207G, but if Mr Dearden's experience is at all general, the vital inspection of earth continuity does not seem to receive the same attention.

Referring to other matters which he raised, the newer wiring techniques, notably that of m.i.c.s. cable, are being increasingly used. The most effective plastics conduits which I have seen used for the carcasing of new concrete structures is the multi-tube, thin bore single-cable type. The tubes in the harness are joined by a web. The tubes have a reasonable wall thickness and the whole system is completely rewirable.

I feel, however, that because of its unrivalled mechanical strength, and other advantages, there will always be a place for screwed conduit, especially in industry, in which case the maximum conduit continuity impedance of 1 ohm must be strictly adhered to.—*"Mid-point."*

Earth on the Ring

IN answer to the comments by "Michet" (31 March issue), I feel I should enlarge on my original article to make the situation a little more clear. The plan of the ring circuit was given only to point out the position of the fault described and not intended to indicate an exact layout. Moreover, the article was only concerned in showing the method of finding the fault devised in the absence of test gear.



Arrangement of conduit to socket-outlet, showing position of fault and of water lying in the tube

However, to complete the picture, I should add that the installation concerned was in conduit; the section in that particular room involved a centrally sited 4 in. by 4 in. by 1½ in. adaptable conduit box, from which radiated four runs of conduit to four socket-outlets. The conduit was fitted in the usual way, by means of locknuts and female bushes.

As shown in the accompanying sketch, the conduit was bent in the shape of a swan neck as is usual to enable it to be taken up behind the skirting board to the outlet. In the faulty section of conduit, the phase conductor was found to have welded on to the conduit. This fault was sited a few inches above some water, which was lying in the swan-neck bend. It was concluded that the water had been lying there for the four years since the house had been built, having entered the conduit at the time of installation. However, in the final clearing up of the trouble, this length was replaced.—*J.H.R.*

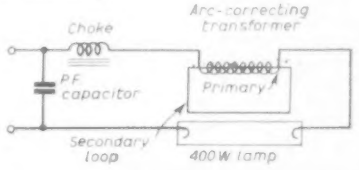
Mixed Connections

A NUMBER of new 400 W mercury-vapour lamps of the horizontally burning type had been installed in a new street lighting scheme. The lamps had been in commission for one night only when a complaint was received that four of the lamps were not operating. Inspection disclosed that in each case the glass envelope of the lamp had either "fused" or had shattered.

The chokes were examined for correct connections in the circuits and found in order. Suspicion then fell on the chokes themselves as being faulty or of the wrong type. As the installation was under guarantee by the makers no further action was taken except that of notifying the makers about the trouble. The following day another report was received that the remainder of the lamps were inoperative. Investigation showed the same symptoms as that disclosed from the first complaint.

As nothing had been heard from the makers after some considerable time it was decided to carry out a private investigation on one of the lamps, which was brought in together with its auxiliary gear. Tests on the choke showed that it was of the correct type and in good order. Rigging up a temporary circuit and fitting a new 400 W m.v. lamp, the current was switched on. Several minutes afterwards it was noticed that the lamp arc, instead of being centrally disposed along the inside of the glass envelope, was bowing upwards and thereby overheating the glass envelope.

Looking into the matter more closely showed that the upward bending of the lamp arc, normally due to convection currents, should have been counteracted by a magnetic device comprising a transformer, whose primary winding consisted of a number of turns of insulated wire which carried the lamp current and whose secondary winding consisted of a single short-circuited loop of heavy square section metal carrying, it was found later, 92 amp. The lower part of this loop was run directly along the top of the lamp.



Correct circuit of 400 W horizontally burning mercury vapour lamp; faulty connection of arc-correcting transformer caused arc to strike and shatter the lamp glass

Interchanging the primary connections of the series transformer cured the trouble. Apparently the effect due to the original connections assisted the convection currents in further upward bending of the arc instead of opposing. Eventually, the manufacturers replaced the whole of the installation with new equipment—*E. A. Robbins.*

Raising Busbar Ratings

WITH the general tendency for factory loads to increase, it is as well to remember that the current-carrying capacity of busbars may be increased by between 20% and 25% by applying a coat of matt finish paint, which increases the rate at which heat is radiated from the bars.

Allowing for a temperature rise of 40° C above an ambient of 30° C, painting will increase the current carrying capacity of a 1 in. by ¼ in. bar from 280 amps to 298 amps, a 2 in. by ¼ in. bar from 510 amps to 553 amps, a 3 in. by ¼ in. bar from 725 to 803 amps, a 3 in. by ½ in. bar from 1.040 to 1.143 amps and a 4 in. by by ½ in. bar from 1.320 to 1.493 amps. These figures assume that the bare copper bar has a bright polished surface, whereas in many cases the surface will have become oxidised. This condition increases heat radiation so that its current carrying capacity is about 10% less than that of a painted bar.—*E.M.*

equipment for industry

Practical platinum plating

RESTRICTION on the production of a satisfactory bright platinum plated finish due to conventional plating baths has now been overcome by the use of a new solution. The solution is acidic and is therefore suitable for deposition on electrical components and for printed circuits. A bright lustrous deposit is claimed which requires no polishing. Accurate control of deposit thickness can be exercised for a deposition rate of 0·0001 in. in two hours with a current density of 5 A/sq ft, although higher deposition rates can, of course, be used. Tests show that the deposit is non-porous in thicknesses up to 0·001 in. on polished copper, but there is some evidence of cracking for greater thicknesses of deposit. *Johnson, Matthey and Co. Ltd., 73 Hatton Gdn, E.C.1.*

Replacing overhead lines

SPEEDY replacement of old overhead line wires by new is made practicable by the Reliance cable drum trailer. The trailer supports a power-driven cable drum for reeling the old conductor and holds a maximum weight of 58 cwt. The drum is power driven through gears by a petrol engine and can exert a pull on the cable of 1,000 lb at 200 ft/min or greater pulls at reduced speeds. The unit is designed to use the old cable as a draw wire to haul in the new line and it is expected to be used primarily for steel cored aluminium cable having

by the main petrol engine, assists in loading and unloading drums. *Reliance Trucks Ltd., Spen Vale Wks, Heckmondwyke, Yorks.*

Plug-in room thermostat

ONE of the introductions at this year's ASEE exhibition was the Proscon room thermostat. This is available in three models suitable for surface or recessed mounting or as a plug-in unit. The thermostat is suitable for a rating of 4 kW at 250 V a.c. or 0·1 A d.c. It has a single pole changeover switch suitable for making or breaking on a rise of temperature and a series on-off switch can also be included. The thermostat has a range from 50 to 80°F as standard with a differential of ±1°F, but other ranges are also available. *Process Control Gear Ltd., Lattimore Rd, St. Albans, Herts.*

Wire live?

POINTING the Metrac live line indicator at an overhead line from the specified safe working distance will give direct indication whether it is energised or isolated. The Metrac tester was developed by the CEGB for use on overhead a.c. lines from 11 to 275 kV, but models are also available which detect domestic voltages. The indicator responds to the electrostatic field associated with a live conductor and has the important merit that if the energising batteries should develop a fault, it fails to safety.

for use in wet weather, the instrument incorporates an illuminated dial for night use. The Metrac can be held in the hand and is supplied with a case for ease of carrying when used on overhead lines. Other uses as a tester for domestic installations include detection of breaks in unscreened cable or earth wires and checking polarity of sockets. *Everett Edgcumbe and Co. Ltd., Colindale Wks, N.W.9.*

Winding small motor stators

A STATOR winding machine originally developed by a well-known company for their own use is now offered to the trade. It is designed for winding stators with bore diameters in the range $\frac{1}{4}$ in. to $1\frac{1}{8}$ in. and is suitable for wire sizes down to 46 s.w.g. The machine has a winding needle whose speed is infinitely variable up to a maximum of 300 strokes per minute. *Catmur Machine Tool Corporation Ltd., 103 Lancaster Rd, Ladbroke Grove, W.11.*

Safer epoxide resins

SOME epoxide resins used for potting electrical components have caused trouble during factory handling by producing dermatitis and eye troubles. The new "Epophen" resins are claimed not to give these ill effects and also to have certain advantages such as low thermal expansion when compared with earlier types of resin. *Leicester Lovell Ltd., North Baddesley, Southampton.*

Fittings for 200 W sodium lamps

PRODUCTION has recently been started by "Real" of flood lanterns and reflectors for 200 W, 3 ft linear sodium lamps. An upward lighting lantern with a specular parabolic asymmetric reflector, list number 942, gives wide angle adjustment of light throw in the vertical plane. It is designed particularly for floodlighting fronts of buildings in the short to medium range and is supplied complete with control gear boxes. For downward lighting, weatherproof dispersive fittings are available, list numbers 945/948. These reflectors are finished grey outside and white inside

Mr F. B. Manning

Mr J. H. Barham

Mr N. E. Wilkinson

Eastern Electricity Board at Purley.

At present on the headquarters staff of the Eastern Electricity Board, **Mr F. B. Manning** has been appointed secretarial officer to the board's Chilterns sub-

staff and more recently was on secondment to Norfolk sub-area as a member of the secretarial officer's staff. Mr Manning recently attended a Communications in Industry course and manage-

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for the electrical trade

Deep fry

A COOKING unit to meet the need of small cafés for deep frying on a limited scale is the "Magifry." This eight-pint capacity cooking pot can be used to prepare several different foods simultaneously or consecutively in the same oil without loss or transfer of flavour. Cooking speeds are high; about three minutes for fish, four for sausages; chips and chicken five minutes. Temperature control is by thermostat operated from a wheel in the base of the stand. "Magifry," a pot 10 in. high and 11½ in. wide at the top has a clean white finish, and lip handles on either side of the rim. It is supplied complete with wire basket. Loading, 1,500 W; price £15 15s. *Magicook Appliances, Carlton Vale, N.W.6.*

Larger dwarf refrigerator

BIG brother to the tiny "Mini-Rex" range of absorption refrigerators is the recently introduced "Mini-Rex Super," itself only 1·7 cu ft capacity. It has 4·5 sq ft of shelf area and, unlike its predecessors, has a freezing compartment—small, but taking a 15-cube ice-making tray. Temperatures can be controlled to −7 deg C. Loading, 35-75 W. Dimensions, 20 in square and 25 in. high. Price, including p.t., is £33 12s. *Commercial Managements Ltd., 90 Archway Rd, N.19.*

Big freeze special

AMPLE freezer space is the highlight of the "Leisure" compressor refrigerator. Its gold-trimmed interior is automatically lit to give the model a final luxury touch. Loading, 75 W; price, £78 15s, including purchase tax. *Allied Ironfoundries, 28 Brook St, W.1.*

Handy vacuum brush

THE hand-grip brush/vacuum cleaner, "VacBrush," can be used for a myriad of odd jobs, and its rotary bristle pad is said to be safe for use on clothing as well as soft furnishings. Only a few inches across, "VacBrush" will clean all the awkward corners which a regular vacuum cleaner cannot negotiate. Motor is self-lubricating and the dust filter can be easily removed for washing. Price: £5 17s 6d, including p.t. *Simplus Products, 31 Alfred Pl, W.C.1.*

Cheaper Electrix dryer

ANOTHER slightly less expensive drying cabinet has been added to the range by Electrix. The new model (319) is mounted on skids and contains rods giving a total of 18 ft hanging room. Red trim finishes the white or cream cabinet. Price £9 18s 9d, including p.t. *Electrix Ltd., Dagenham, Essex.*

GEC washer launched

GEC's single tub washer-spinner, "Double Plus," already introduced to the Midlands and North, is launched nationally as from 16 May. This machine is compact and comparatively noiseless, its twin pulsators giving what is claimed to be a more thorough wash-

an affiliate of the American G.E. concern, relies for all-night security and comfort upon two independent control devices, the Sleep Guard system, and a room temperature response control. The first of these is incorporated into the elements themselves so that every inch of the blanket is guarded against overheating—there can be no hotspots without the blanket cutting out. Elements consist of a core with copper winding, a layer of nylon with a signal wire wound around it and a final insulation of plastic. Nylon is comparatively non-conductive up to a temperature of 200 deg F, after which its resistance declines rapidly; thus when this temperature is reached the signal wire picks up the current and automatically switches the blanket off. After this it must be turned on again by hand. This control enables the maximum temperature to be safely used for pre-warming and airing of the bed. The other control is a room thermostat which will adjust heat output of the blanket according to fluctuating ambient temperatures during the night.

These blankets differ from the normal run in that they are true tuck-in blankets and not simply overlays. Produced in single-bed and double-bed sizes, the larger type can have independent heating for both halves of its length. Colours available are blue, pink and green. Prices £11 11s single, £13 13s double, and £15 15s for the two-heat model. Loadings 140 W and 190 W. *Monogram Electric Ltd., 302 High Holborn, W.C.1.*

Home laundry

NOW available through electrical wholesalers is a three-in-one washing machine, the "Trident," which washes/rinses and spin-dries 7 lb of clothes in one tub. A single lever controls all processes. In this machine the agitator is an integral part of the inner (perforated) drum, the whole of which oscillates. Operation is by a single phase 150 W motor. Controls are on a panel in front which also carries the signal light. Its double-lidded top is flat. This machine

make it easier; all make instructive reading.

PRACTICE

Conduit Continuity

ONE can extend the greatest sympathy to Mr Dearden (28 April issue) in his criticism of "slap-dash" work, but when he states that this is carried out by well-known firms the reader can be forgiven for wondering what the National Inspection Council for Electrical Installation Contracting is doing about it. This

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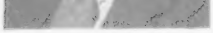


Mr F. B. Manning

Mr J. H. Barham

Mr N. E. Wilkinson

Eastern Electricity Board at Purley.

At present on the headquarters staff of the Eastern Electricity Board, **Mr F. B. Manning** has been appointed secretarial officer to the board's Chilterns sub-area, in succession to **Mr F. G. Page**, A.C.I.S., who is retiring (*ESH, page 106.) A Lincolnshire man, Frank Manning has been associated with electricity supply for most of his working life. At Peterborough, where he worked for the municipal authority, he was the clerk to the electricity committee and later transferred to Luton Corporation in a similar capacity. He joined the Eastern Electricity Board in 1949 as the principal assistant to **Mr L. A. Jackson**, who is now the deputy secretary; in 1958 he became a member of the establishments staff and more recently was on secondment to Norfolk sub-area as a member of the secretarial officer's staff. Mr Manning recently attended a Communications in Industry course and management course sponsored by the Electricity Council.

Mr J. H. Barham has been appointed Birmingham area representative for Chilton Electric Products Ltd. covering Shropshire and Staffordshire (as far north as, and including, Shrewsbury, Wellington and Stafford) to the borders of Staffordshire and Derbyshire and including Warwickshire, Worcestershire, Herefordshire, Monmouthshire, Glamorganshire, Carmarthenshire and also Gloucestershire. Previously he was rep. for Telcon.

Board in succession to **Mr H. E. A. Donnelly**, M.C., T.D., A.M.S.I.M. Mr Greaves has been in the electricity supply industry for 27 years, including pre-nationalisation appointments with municipal undertakings, and is at present establishments officer with the North West, Merseyside and North Wales Region of the CEGB. (*ESH, pages 73/141.)

Mr Harold Doust, A.M.I.E.E., will be retiring from the service of the Yorkshire Electricity Board on 6 June, after 46 years in the industry. Mr Doust commenced with the Grimsby Corporation in 1914 and became district engineer. In 1931 he joined the Louth Corporation as engineer and manager of the Electricity Department and in May, 1948, was appointed manager of the board's Gainsborough district, from which position he now retires. Mr Doust will be succeeded by **Mr E. H. Jubb**, A.M.I.E.E., who is at present senior assistant engineer (commercial) in the board's Grimsby sub-area. (*ESH, page 147.)

OBITUARY

Mr P. J. Fell, A.M.I.E.E., East Midlands area manager of A. Reyrolle and Co. Ltd., died on 8 May, aged 44. Mr Fell was educated at Faraday House and joined Reyrolle's technical research staff in 1937 as a student apprentice. Following service in the Navy he returned to Hebburn as a contracts engineer, and served as a district engineer in the Company's Manchester and Leeds offices between 1952 and 1956.

Mr C. C. Cockbain, sales manager and engineer with Bullers Ltd., died on 8 May, aged 65. He joined the company in 1912 and was closely connected with the early developments of h.v. overhead transmission.

Mr F. L. Smith, area electrical engineer for the No. 6 area of the Durham Divisional Coal Board, has died, aged 58.

With the death on 12 May of **Mr T. L. Horn**, M.I.E.E., at the age of 90, a link with the early days of electric tramways in London has been severed. Mr Horn was divisional electrical engineer in the Tramways Department of the former London Passenger Transport Board, from which position he retired in 1935. He first became associated with the LCC Tramways as the representative of Siemens Bros., to whom was entrusted the installation of the original h.t. cables. Later he was appointed distribution engineer to the undertaking.

NEW LITERATURE

Year Book of the Heating and Ventilating Industry

THE backbone of this Year Book is, as usual, a list of the trade's more important agreements for employment and for trading, and an extensive buyer's guide. Also included are a number of technical articles of topical interest. Mr L. G. Fischer discusses considerations in heating and ventilating design that affect choice of sizes for pipes and ducts, and Dr C. N. Davies suggests a scientific basis of heating design for large poultry houses. Warm air heating for domestic and commercial buildings is a subject of another article by Dr W. Davidson. Amongst other contents is an index to heating and ventilating literature published in 1958. Also included is a selected list of British Standards. Published by Technitrade Journals Ltd., 464 pages, 8¼ in. by 5¼ in. Thirteenth edition, price 16s 6d.

Basic Audio. Vols 1, 2 & 3

by N. H. Crowhurst

THE author states in his preface that these three books are suitable for the practical man who, lacking academic background, finds it difficult to grasp technical literature which he reads with only "intuitive comprehension." If the reader understands this phrase and can interpret Americanisms such as "finagling" which appear from time to time in the text he may well find this a useful introduction to audio techniques. The book covers most aspects of audio practice from acoustics to impedance matching and stereophony. However, the treatment is essentially elementary and about half of each book is devoted to line illustrations which make great use of modern visual aid techniques. Equations, for example, are represented by cartoon-like diagrams. Whether these really present a clearer picture to the reader than a conventionally laid-out book is doubtful. Published by Chapman and Hall; 9 in. by 6 in.; Vol. 1, 114 pages; Vol. 2, 122 pages; Vol. 3, 113 pages. Price 23s each.

Electrical Trades' Directory, 1960

ALL who have regularly used the annual Blue Book will welcome the appearance of the 1960 edition, for it brings up to date again the vast array of information on the electrical industry. It conforms to the same pattern of its predecessors, with eleven sections covering manufacturers, merchants, contractors, wholesalers, engineers, products and trade names, etc. Apart from the alphabetical list of firms, probably the most valuable section is the classified list of suppliers of various equipment which has been extended still further and now occupies over 1,100 pages. A general index, placed at the rear this time, provides rapid reference to any firm named in this invaluable directory. Published by Benn Brothers. 1,700 pages. 9 in. by 6 in. Price 63s.

Conduit Continuity

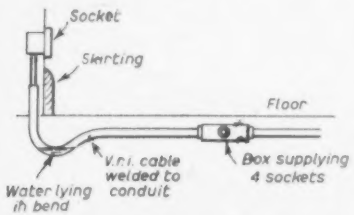
ONE can extend the greatest sympathy to Mr Dearden (28 April issue) in his criticism of "slap-dash" work, but when he states that this is carried out by well-known firms the reader can be forgiven for wondering what the National Inspection Council for Electrical Installation Contracting is doing about it. This august body appears to be very energetic in crawling along lofts to observe whether ceiling outlets are fully protected to conform with the requirements of IEE Reg. 207G, but if Mr Dearden's experience is at all general, the vital inspection of earth continuity does not seem to receive the same attention.

Referring to other matters which he raised, the newer wiring techniques, notably that of m.i.c.s. cable, are being increasingly used. The most effective plastics conduits which I have seen used for the carcasing of new concrete structures is the multi-tube, thin bore single-cable type. The tubes in the harness are joined by a web. The tubes have a reasonable wall thickness and the whole system is completely rewirable.

I feel, however, that because of its unrivalled mechanical strength, and other advantages, there will always be a place for screwed conduit, especially in industry, in which case the maximum conduit continuity impedance of 1 ohm must be strictly adhered to.—*"Mid-point."*

Earth on the Ring

IN answer to the comments by "Michet" (31 March issue), I feel I should enlarge on my original article to make the situation a little more clear. The plan of the ring circuit was given only to point out the position of the fault described and not intended to indicate an exact layout. Moreover, the article was only concerned in showing the method of finding the fault devised in the absence of test gear.



Arrangement of conduit to socket-outlet, showing position of fault and of water lying in the tube

However, to complete the picture, I should add that the installation concerned was in conduit; the section in that particular room involved a centrally sited 4 in. by 4 in. by 1½ in. adaptable conduit box, from which radiated four runs of conduit to four socket-outlets. The conduit was fitted in the usual way, by means of locknuts and female bushes.

As shown in the accompanying sketch, the vertical run to the skirting board was in the shape of a swan neck as is usual to enable it to be taken up behind the skirting board to the outlet. In the faulty section of conduit, the phase conductor was found to have welded on to the conduit. This fault was sited a few inches above some water, which was lying in the swan-neck bend. It was concluded that the water had been lying there for the four years since the house had been built, having entered the conduit at the time of installation. However, in the final clearing up of the trouble, this length was replaced.—*J.H.R.*

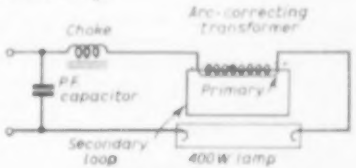
Mixed Connections

A NUMBER of new 400 W mercury-vapour lamps of the horizontally burning type had been installed in a new street lighting scheme. The lamps had been in commission for one night only when a complaint was received that four of the lamps were not operating. Inspection disclosed that in each case the glass envelope of the lamp had either "fused" or had shattered.

The chokes were examined for correct connections in the circuits and found in order. Suspicion then fell on the chokes themselves as being faulty or of the wrong type. As the installation was under guarantee by the makers no further action was taken except that of notifying the makers about the trouble. The following day another report was received that the remainder of the lamps were inoperative. Investigation showed the same symptoms as that disclosed from the first complaint.

As nothing had been heard from the makers after some considerable time it was decided to carry out a private investigation on one of the lamps, which was brought in together with its auxiliary gear. Tests on the choke showed that it was of the correct type and in good order. Rigging up a temporary circuit and fitting a new 400 W m.v. lamp, the current was switched on. Several minutes afterwards it was noticed that the lamp arc, instead of being centrally disposed along the inside of the glass envelope, was bowing upwards and thereby overheating the glass envelope.

Looking into the matter more closely showed that the upward bending of the lamp arc, normally due to convection currents, should have been counteracted by a magnetic device comprising a transformer, whose primary winding consisted of a number of turns of insulated wire which carried the lamp current and whose secondary winding consisted of a single short-circuited loop of heavy square section metal carrying, it was found later, 92 amp. The lower part of this loop was run directly along the top of the lamp.



Correct circuit of 400 W horizontally burning mercury vapour lamp; faulty connection of arc-correcting transformer caused arc to strike and shatter the lamp glass

Interchanging the primary connections of the series transformer cured the trouble. Apparently the effect due to the original connections assisted the convection currents in further upward bending of the arc instead of opposing. Eventually, the manufacturers replaced the whole of the installation with new equipment—*E. A. Robbins.*

Raising Busbar Ratings

WITH the general tendency for factory loads to increase, it is as well to remember that the current-carrying capacity of busbars may be increased by between 20% and 25% by applying a coat of matt finish paint, which increases the rate at which heat is radiated from the bars.

Allowing for a temperature rise of 40° C above an ambient of 30° C, painting will increase the current carrying capacity of a 1 in. by ¼ in. bar from 280 amps to 298 amps, a 2 in. by ¼ in. bar from 510 amps to 553 amps, a 3 in. by ¼ in. bar from 725 to 803 amps, a 3 in. by ¼ in. bar from 1,040 to 1,143 amps and a 4 in. by by ¼ in. bar from 1,320 to 1,493 amps. These figures assume that the bare copper bar has a bright polished surface, whereas in many cases the surface will have become oxidised. This condition increases heat radiation so that its current carrying capacity is about 10% less than that of a painted bar.—*E.M.*

equipment for industry

Practical platinum plating

RESTRICTION on the production of a satisfactory bright platinum plated finish due to conventional plating baths has now been overcome by the use of a new solution. The solution is acidic and is therefore suitable for deposition on electrical components and for printed circuits. A bright lustrous deposit is claimed which requires no polishing. Accurate control of deposit thickness can be exercised for a deposition rate of 0·0001 in. in two hours with a current density of 5 A/sq ft, although higher deposition rates can, of course, be used. Tests show that the deposit is non-porous in thicknesses up to 0·001 in. on polished copper, but there is some evidence of cracking for greater thicknesses of deposit. *Johnson, Matthey and Co. Ltd., 73 Hatton Gdn, E.C.1.*

Replacing overhead lines

SPEEDY replacement of old overhead line wires by new is made practicable by the Reliance cable drum trailer. The trailer supports a power-driven cable drum for reeling the old conductor and holds a maximum weight of 58 cwt. The drum is power driven through gears by a petrol engine and can exert a pull on the cable of 1,000 lb at 200 ft/min or greater pulls at reduced speeds. The unit is designed to use the old cable as a draw wire to haul in the new line and it is expected to be used primarily for steel cored aluminium cable having an overall diameter of 0·77 in. The trailer unit has turntable steering and twin rear wheels to help manoeuvrability in difficult country. Quick replacement of the conductor drum is effected by hydraulically actuated side arms for lifting and lowering. A winch, also driven by the main petrol engine, assists in loading and unloading drums. *Reliance Trucks Ltd., Spen Vale Wks, Heckmondwyke, Yorks.*

Plug-in room thermostat

ONE of the introductions at this year's ASEE exhibition was the Proscon room thermostat. This is available in three models suitable for surface or recessed mounting or as a plug-in unit. The thermostat is suitable for a rating of 4 kW at 250 V a.c. or 0·1 A d.c. It has a single pole changeover switch suitable for making or breaking on a rise of temperature and a series on-off switch can also be included. The thermostat has a range from 50 to 80°F as standard with a differential of ±1°F, but other ranges are also available. *Process Control Gear Ltd., Lattimore Rd, St. Albans, Herts.*

Wire live?

POINTING the Metrac live line indicator at an overhead line from the specified safe working distance will give direct indication whether it is energised or isolated. The Metrac tester was developed by the CEGB for use on overhead a.c. lines from 11 to 275 kV, but models are also available which detect domestic voltages. The indicator responds to the electrostatic field associated with a live conductor and has the important merit that if the energising batteries should develop a fault, it fails to safety. Models are available for use on overhead lines, and with protected electrodes which can be offered up to spouts on metal-clad switchgear with safety. The Metrac is press-button operated, ensuring that the h.t. and l.t. batteries are used for only a short time. Said to be safe for use in wet weather, the instrument incorporates an illuminated dial for night use. The Metrac can be held in the hand and is supplied with a case for ease of carrying when used on overhead lines. Other uses as a tester for domestic installations include detection of breaks in unscreened cable or earth wires and checking polarity of sockets. *Everett Edgcumbe and Co. Ltd., Colindale Wks, N.W.9.*

Winding small motor stators

A STATOR winding machine originally developed by a well-known company for their own use is now offered to the trade. It is designed for winding stators with bore diameters in the range $\frac{1}{4}$ in. to $\frac{15}{16}$ in. and is suitable for wire sizes down to 46 s.w.g. The machine has a winding needle whose speed is infinitely variable up to a maximum of 300 strokes per minute. *Catmur Machine Tool Corporation Ltd., 103 Lancaster Rd, Ladbroke Grove, W.11.*

Safer epoxide resins

SOME epoxide resins used for potting electrical components have caused trouble during factory handling by producing dermatitis and eye troubles. The new "Epophen" resins are claimed not to give these ill effects and also to have certain advantages such as low thermal expansion when compared with earlier types of resin. *Leicester Lovell Ltd., North Baddesley, Southampton.*

Fittings for 200 W sodium lamps

PRODUCTION has recently been started by "Real" of flood lanterns and reflectors for 200 W, 3 ft linear sodium lamps. An upward lighting lantern with a specular parabolic asymmetric reflector, list number 942, gives wide angle adjustment of light throw in the vertical plane. It is designed particularly for floodlighting fronts of buildings in the short to medium range and is supplied complete with control gear boxes. For downward lighting, weatherproof dispersive fittings are available, list numbers 945/948. These reflectors are finished grey outside and white inside and have anti-corrosion treatment "B." One light and two light models in either open or enclosed pattern are now available. All these fittings have a toughened glass front. *Rowlands Electrical Accessories Ltd., Real Wks, Hockley Hill, Birmingham 18.*

◀ *Cable drum trailer by Reliance drawing in new o/h line conductors using old cable as draw wire*

Two of the REAL floodlights for 200 W 3 ft linear sodium type tubes ▶

for the electrical trade

Deep fry

A COOKING unit to meet the need of small cafés for deep frying on a limited scale is the "Magifry." This eight-pint capacity cooking pot can be used to prepare several different foods simultaneously or consecutively in the same oil without loss or transfer of flavour. Cooking speeds are high; about three minutes for fish, four for sausages; chips and chicken five minutes. Temperature control is by thermostat operated from a wheel in the base of the stand. "Magifry," a pot 10 in. high and 11½ in. wide at the top has a clean white finish, and lip handles on either side of the rim. It is supplied complete with wire basket. Loading, 1,500 W; price £15 15s. *Magicook Appliances, Carlton Vale, N.W.6.*

Larger dwarf refrigerator

BIG brother to the tiny "Mini-Rex" range of absorption refrigerators is the recently introduced "Mini-Rex Super," itself only 1·7 cu ft capacity. It has 4·5 sq ft of shelf area and, unlike its predecessors, has a freezing compartment—small, but taking a 15-cube ice-making tray. Temperatures can be controlled to −7 deg C. Loading, 35-75 W. Dimensions, 20 in square and 25 in. high. Price, including p.t., is £33 12s. *Commercial Managements Ltd., 90 Archway Rd, N.19.*

Big freeze special

AMPLE freezer space is the highlight of the "Leisure" compressor refrigerator. Its full-width compartment will accommodate 20 average size packets of frozen food without frosting and has an extra large chill tray. This cabinet, a 5½ cu ft capacity model with 11 sq ft of shelf area, can be locked against inquisitive youngsters. Two-toned and gold-trimmed interior is automatically lit to give the model a final luxury touch. Loading, 75 W; price, £78 15s, including purchase tax. *Allied Ironfoundries, 28 Brook St, W.1.*

Handy vacuum brush

THE hand-grip brush/vacuum cleaner, "VacBrush," can be used for a myriad of odd jobs, and its rotary bristle pad is said to be safe for use on clothing as well as soft furnishings. Only a few inches across, "VacBrush" will clean all the awkward corners which a regular vacuum cleaner cannot negotiate. Motor is self-lubricating and the dust filter can be easily removed for washing. Price: £5 17s 6d, including p.t. *Simplus Products, 31 Alfred Pl, W.C.1.*

Cheaper Electrix dryer

ANOTHER slightly less expensive drying cabinet has been added to the range by Electrix. The new model (319) is mounted on skids and contains rods giving a total of 18 ft hanging room. Red trim finishes the white or cream cabinet. Price £9 18s 9d, including p.t. *Electrix Ltd., Dagenham, Essex.*

GEC washer launched

GEC's single tubwasher-spinner, "Double-Plus," already introduced to the Midlands and North, is launched nationally as from 16 May. This machine is compact and comparatively noiseless, its twin pulsators giving what is claimed to be a more thorough washing action. Price £83 9s 6d.

Safety blanket

AN electric blanket, the first product manufactured in this country by the newly formed Monogram Electric Ltd., an affiliate of the American G.E. concern, relies for all-night security and comfort upon two independent control devices, the Sleep Guard system, and a room temperature response control. The first of these is incorporated into the elements themselves so that every inch of the blanket is guarded against overheating—there can be no hotspots without the blanket cutting out. Elements consist of a core with copper winding, a layer of nylon with a signal wire wound around it and a final insulation of plastic. Nylon is comparatively non-conductive up to a temperature of 200 deg F, after which its resistance declines rapidly; thus when this temperature is reached the signal wire picks up the current and automatically switches the blanket off. After this it must be turned on again by hand. This control enables the maximum temperature to be safely used for pre-warming and airing of the bed. The other control is a room thermostat which will adjust heat output of the blanket according to fluctuating ambient temperatures during the night.

These blankets differ from the normal run in that they are true tuck-in blankets and not simply overlays. Produced in single-bed and double-bed sizes, the larger type can have independent heating for both halves of its length. Colours available are blue, pink and green. Prices £11 11s single, £13 13s double, and £15 15s for the two-heat model. Loadings 140 W and 190 W. *Monogram Electric Ltd., 302 High Holborn, W.C.1.*

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◀ *"Leisure" has extra freezer space and a generous chill tray. £78 15s*

"Trident's" three purpose inner drum showing integral agitators. £72 9s ▶

Radioisotopes for Industry

OF the work of the Atomic Energy Research Establishment, Harwell, one of the most important, if least publicised, activities has been their extensive development of radioactive isotopes for use in all fields of working life. Recognition of the important place these materials now hold has been given by the creation, over the last three years, of a radioisotope establishment at Wantage, which houses the Isotope Division of AERE. We were last week privileged to visit the Wantage Radiation Laboratories, prior to the formal opening by the Minister of Science, Lord Hailsham, on Monday.

There are five main groups in the Isotope Division: Technological Irradiation Group, whose work is concerned with radiation effects in the initiation of chemical reactions (polymerisation of plastics, etc.); the Physics Group, who carry the main load of the division's experimental and advisory service for industry, medicine and other spheres; the Chemistry Group, concerned with the chemical aspects of using radioisotopes in industry and medicine, the Reactors and Measurements Group (still at Harwell) who are studying experimental reactor irradiations and radioactivity measurements, and the Industrial Liaison Group, who demonstrate the potentialities of radioisotope applications in commercial processes.

Thickness gauging

For industry, the work of the Physics Group is of particular importance. An aspect of their work is developing methods of thickness gauging and analysis for those situations where there is access only to one side of the object whose thickness is being measured. One method employs the familiar back-scatter technique, in which radiations directed at the surface will be scattered backwards and can then be detected. The intensity of radiation scattered back to the detector, which is a scintillation counter, increases with increasing wall thickness. The scattered radiation has a considerably lower energy than that of the originating radiation but it is counted preferentially by employing a thin crystal which is sensitive only to low energy radiation. In this way there is no need to shield the detector from the radiation source.

For this method, radioactive isotopes emitting gamma and X-rays provide stable, portable and relatively cheap sources of electromagnetic radiation, but there are, however, few long-lived sources available emitting radiation in the important energy region below 100 keV. To overcome this shortage, a new thickness measuring technique makes use of electron-excited sources of radiation. The radiation is produced in exactly the same way as in an X-ray tube; the electrons (or beta rays) are made to impinge on a target to produce the required gamma rays.

Another form of the same technique uses beta rays directly, relying on production of X-rays in the material being measured. This X-ray fluorescence is particularly suitable for measuring the thicknesses of coatings, such as tinplate on steel. Simple analysis of chemical content of the material being irradiated (copper content of brass for example) is also possible, by means of measuring the differential absorption of the X-rays.

An example of the service provided by the laboratories was an account of radioactive tracing carried out for the glass firm of Pilkingtons. The problem was to determine whether mixing of various types of sand used for the glass was efficient, as a prerequisite to deciding whether new plant should be installed. A suitable radioactive material was added to one of the sands, and its dispersion in the mix throughout production determined by means of suitable detectors and it showed, in this case, that complete homogenity was being achieved.

E.D.A. RESPONSIBILITIES

PRINCIPAL guest at last week's annual luncheon of the Electrical Development Association was the Minister of Power, Mr R. Wood, M.P. Speaking at a major electrical function for the second time in a week, he yet found some new points to make. Central theme of his speech was the clash between the demands of the electrical industry for more capital, on which some limits had to be placed, and the unrestricted growth of electricity.

Mr Wood recalled that the proportion of the country's fuel consumed in generating stations had risen from between one-sixth and one-seventh in 1949 to nearly one-quarter by 1959. Sixty new power stations had been built in this country in that period. These developments, together with the beginning of nuclear generation and the expansion of supergrid, had required much stepping up of capital expenditure and had placed a considerable burden on the nation and on the supply industry.

The steady growth in capital expenditure by the industry placed a big responsibility on EDA, for it was vitally necessary to show consumers possible uses of electricity so that they could benefit the supply industry as well as themselves. High capital expenditure could be more easily borne if consumers could be persuaded of the value of all load building appliances.

The question would be asked whether there were any limits to electricity expansion in the future. Expansion would be limited by the need of the Government to ensure, in authorising capital expenditure, that investment would be used to the best advantage and that it could earn its repayment. Within those limits expansion of the industry would continue and EDA would be largely responsible for the rate at which it was achieved.

Fuels in the future

The reply to the Minister came from Sir Josiah Eccles, deputy chairman, Electricity Council, and retiring president of EDA. He pointed out that if electricity continued its traditional rate of progress, doubling every ten years, then in 20 years time, with to-day's efficiency of generation, the supply industry would consume the whole of the NCB'S production. Of course, efficiency would improve by then. However, in the foreseeable future new fuels would be necessary and they were being developed. It was a challenge and an opportunity to be at the spearhead of such a service as electricity supply. But

Lord Morrison of Lambeth chats with new EDA Chairman, Mr D. B. Irving

it was not the least use to make the best product in the world if no one heard about it. EDA was not just a publicity agency—it was an integral part of the service the industry was trying to render its customers.

Looking to the future Sir Josiah remarked that there was much leeway to make up in Britain's industrial processes if the country was to remain competitive. The motor industry was one of the most efficient, but for every ton of finished motor car, there was a ton of wasted material because of the inaccuracy of the processes. In every foundry, for every ton of finished castings, 100 tons of material were handled between the stockyard and the fettling shop. If these were inescapable procedures then at least electricity through mechanical handling could make them as efficient as possible.

News of the Week

WESTERN EUROPE COUNCIL FOR APPLIANCE MANUFACTURERS

Six and Seven talk at B.E.A.M.A. meeting

WIDER international linking between manufacturers of electrical domestic appliances is the hoped-for outcome of a meeting organised in London last week by BEAMA Manufacturers representing both the "Six" of the European Common Market and the "Outer Seven" European Free Trade Association came together at a meeting of CECED (Conseil Europeen de la Construction Electro-Domestique).

The council was meeting in London to discuss technical, commercial and financial matters affecting its members. On the initiative of the UK, representatives of electrical manufacturers in Sweden, Finland, Denmark and Austria were invited to London at the same time, so that they were able to take part in informal talks with the existing CECED members — Germany, France, Italy, Belgium, the Netherlands, Switzerland and the United Kingdom.

The outcome has been a cordial invitation from CECED to the four countries represented in London, and to Norway as well, to join CECED, and so form an organisation representative of the main countries of Western Europe concerned with manufacturing household electrical equipment.

Technical and financial matters will come within the ambit of the enlarged organisation, which in the usual way of trade associations will provide facilities for exchange of information and statistics to help development of the industry generally.

Comments on the new move came from M Coite, of France, president of the CECED, and Mr S. F. Steward, director of BEAMA. M Coite said: "A new spirit of co-operation is already growing up among manufacturers within the Common Market—a spirit which we should like to see extended throughout the whole of Western Europe. We think today that we have played our part, and we in France are ensuring that this decision is brought to the attention of the French delegates to the forthcoming Summit Meeting of Heads of State to be held in Paris.

"We hope that our decision to invite manufacturers of domestic electrical appliances in other countries of Western Europe to join us will be only the beginning of a new era of industrial co-operation." To this Mr Steward added: "We in BEAMA have supported this action because we believe that any move towards closer relations among manufacturers in a major industry such as ours will point the way to wider co-operation between our countries in the economic field. We have received encouragement from the President of the Board of Trade, when he attended our Export Conference, to bring about this continuing consultation in the electrical appliances industry."

At the meeting of W. Europe domestic electrical appliance manufacturers in London last week; l. to r.: Mr Felix Rogers (BEAMA), Mr T. Wedholm (Sweden), Mr R. Flink (Finland), Mr H. Tohlin (Sweden) and Mr S. F. Steward (director, BEAMA)

Batwin acquired

TOTAL share capital of Batwin Electric Motors Ltd., of Richmond, Surrey, has been acquired by London Fan and Motor Co. Ltd., who are moving their offices on 1 June to Batwin's present premises at 331 Sandycombe Rd, Richmond (Tel.: Richmond 0157). The factory of London Fan and Motor is being extensively reorganised and re-equipped.

Wiring of imported appliances

HOUSE of Commons questioners pressed the Board of Trade for early legislation to deal with colour coding of imported appliances, when they raised the matter of the Molony Committee recommendations on the matter last week. The Parliamentary Secretary to the BoT said there were good prospects of a final agreement on a new European standard for core colours in flexible cords to be reached during May. He emphasised that there was at present no power to impose restrictions on imports of electrical appliances, and that legislation would have to await the general consideration of the Molony Committee recommendations now being made by the Home Secretary and the President of the BoT.

Sales and H.P. in March

HIRE purchase and other instalment debt owed to household goods shops and finance houses rose by £31 million in March, compared with rises of £16 million in Jan. and Feb., according to the latest Board of Trade figures. Total increase on March, 1959, was 27%.

Retail sales continued to rise, and were 4% higher in March compared with a year earlier. Sales of electrical and radio goods by independent retailers were 16% up on March, 1959, while department stores sold 36% more. Provisional figures for April show a general sales gain of 6% on a year earlier.

"Six" agree to speed tariff cuts

THE Hallstein plan for speeding up the Common Market programme of tariff reductions was agreed in principle last week by the Ministers of the Six at a meeting in Luxemburg. But the proposed internal tariff cut will now be made in two stages —10% on 1 July next and 10% on 1 January, 1961, instead of 20% in July as originally planned.

External tariffs will, however, only be reduced if there is "sufficient reciprocity" from other nations outside the Six, principally the UK and the USA. A provisional reduction of 20% is envisaged.

According to Professor Hallstein, the effect of the changes by the end of 1961 will be that internal tariffs between the Common Market countries will have been reduced by 40% from pre-treaty levels. This is less than the figure of 50% formerly specified.

The Ministers also approved a "declaration of intent" calling for trade talks between the Six and the Seven at the next meeting of the 21-member trade group to be held in Paris on 8 June.

Proposals for Standards Engineers' Association

PROPOSALS for the setting up of a Standard Engineers' Association were further discussed at last week's Sixth Conference of Engineers Responsible for Standards, jointly organised by the DSI and IPE in London. The chairman, Mr R. E. Mills, also chairman of the IPE Standards Committee, introduced Mr H. A. R. Binney, director of BSI, who outlined steps which had been taken to implement last year's resolution. A committee had been formed on which the BSI and IPE were represented as well as a number of those who had expressed particular interest in the subject. They had considered the setting up of a UK branch of the American society (entrance fee $2, annual subscription $10) but had not found that this proposal commended much enthusiasm among engineers here, though there was much to be gained by close liaison with this body. On the other hand, the BSI was doubtful about the wisdom of sponsoring the formation of a new society at a time when there were already many others making calls upon the time of those employed in industry.

It had been suggested that the BSI should offer, as a temporary measure, special associateship on a personal basis with a small subscription, say one guinea, to all who were interested in the maintenance of standards in industry and, if the response was adequate, the body of members could then "hive themselves off" from the BSI to form the separate society on a regional basis. In this manner the strength of support for the society could be tested before any serious commitment had been entered into. The BSI had prepared a form for issue to anyone who was interested and in which the willingness of the subscriber to undertake organising responsibilities was also requested.

Put to the vote, this suggestion was almost unanimously approved, the only four dissentients already being members of the American society. It was agreed that the first meeting should take place in London on or about July 9. Other engineers interested can obtain a copy from the BSI at 2 Park St, W.1.

In the morning, Mr Lewis Wright, past-chairman of the British Productivity Council and chairman of the TUC Production Committee, called for earlier consultation with the shops in the formulation of standards and standard practices. Mr McNeill, chief engineer of Unilever Ltd., discussed problems arising from the use of British and company standards simultaneously, Mr I. R. Smith, of Bristol Aircraft, dealt with the place of standards in production and quality control and Mr T. R. B. Saunders gave a résumé of the effects of changes in unitary standards from inch to metric measurement.

Durgapur Plant operating

WITH the commissioning of the 42 in. blooming mill at India's Durgapur steel project, the AEI Heavy Plant Division have completed the supply and installation of the electrical equipment for the first of the primary mills in stage II of the project. (Stage I, the coke oven battery and blast furnace plant, started up in December.) Stage II of the project includes the steelmaking and the production of ingots from the primary mills. The twin drive for the 42 in. blooming mill consists of two 3,000 h.p. d.c. motors. The main mill motors are supplied by a flywheel m.g. set consisting of four 1,200 kW (which provide the main drive) and two 480 kW generators (for the bloom shear motors) driven by a 5,000 h.p. induction motor. The flywheel has a stored energy capacity of 200,000 h.p.-seconds.

Record Cooker Sales in March

MARCH was a boom month for sales of major appliances by the Electricity Boards in England and Wales. Cooker sales, at 32,693, were a record—the previous highest month's total was 32,293 in November, 1958, immediately following the lifting of hire-purchase controls.

Appliance Sales by Area Boards	Sales in month ended 31 March, 1960		Sales in 12 months ended 31 March, 1960	
	Total	% change over corresponding period of 1959	Total	% change over previous 12 months
Cookers ...	32,693	+15.2	345,923	+21.2
Water Heaters:				
Immersion	15,872	+26.7	194,537	+16.4
Storage ...	7,218	+59.4	64,625	+24.1
Washboilers	5,428	− 6.0	65,383	−16.1
Washing Machines...	12,116	+21.1	161,996	+28.2
Refrigerators	9,910	+92.9	172,539	+108.7

Sales of refrigerators, too, were the highest since last September. Substantial increases were also recorded for the other items listed in our table, apart from washboilers, the steady decline in sales of which continues. These statistics of the area board sales represent only a part of the total sales throughout the country, of course.

S.E.B. reduce off-peak tariff

AS from 30 June next, the standard domestic off-peak tariffs of the Southern Electricity Board are being reduced by 0·1d p.u. This change will have the effect of bringing these tariffs into line with those to non-domestic premises at the cost of fuel for 1961-62 as estimated by the CEGB.

EXHIBITION TO COST MORE?

RISING costs may necessitate a slight increase in the charges made to exhibitors for space rental at the next Electrical Engineers' Exhibition, it was announced at the annual exhibitors' meeting held in London last week under the chairmanship of Mr R. F. Mathieson. Space charges have remained unchanged since 1957.

After paying tribute to the technical press for their support, the chairman reaffirmed the policy of the exhibition organising committee in maintaining the essentially British character of the exhibition and in excluding the public, and refuted claims by a group of exhibitors that they had "materially affected" this policy.

As in previous years, the most important point raised by various exhibitors at the meeting was the question of some form of sectionalisation. Although the body of opinion seemed to be opposed to this, the chairman said that the final decision would depend on the result of a postal ballot in which all exhibitors would be asked to participate. Finally, it was announced that the exhibition company was again donating 400 gn to the EIBA.

Visiting the Birmingham works of George Ellison Ltd. last week, the Electrical Committee of the Engineering Equipment Users' Association took advantage of the opportunity to see a demonstration short circuit test on an Ellison 400 A fuse-switch with 200 A fuse links. The test was witnessed at 440 V, 35 MVA (46,000 A) and was carried out in the company's ASTA authorised testing station. Pictured above are Col W. E. Dennis, W. J. Outram, C. F. Freeman, R. P. McCulloch, D. Birch and E. W. W. Double (EEUA members) with J. R. T. White and B. Graham, of George Ellison Ltd., examining a 550 V a.c. heavy-duty fuse switchboard

Streamlining Refrigerator Production

WITH a potential market of one million refrigerators a year, and foreign imports reaching new high levels, the question poses itself: what is the British refrigeration industry doing to meet the challenge of this developing and highly competitive market? Last week the Domestic Refrigeration Development Committee and Electrolux Ltd. jointly provided a satisfying answer to this topical question by showing the Press how the Electrolux factory at Luton has been extended and streamlined to step up 'fridge production by 75%.

In the first stage of the development scheme the area of the factory has been increased from 600,000 to 700,000 sq ft. The second stage, involving the addition of a further 120,000 sq ft, is due for completion by the end of 1960. At the same time production methods have been reorganised to allow for new methods of flow production to replace some of the batch production previously carried out. By the end of this year the factory, it is claimed, will be one of the largest and most modern in Europe, capable of producing nearly three refrigerators a minute.

Two new flow lines have been installed for the production of small and large refrigerators, respectively, starting with raw materials comprising steel tubing and components for the freezing units, and sheet steel for the cabinets, and terminating on the final assembly lines where the completed and tested models are packed for despatch.

Electrostatic painting is used in place of conventional hand spraying. This fully automatic process uses a 100 kV charge to atomise paint released from 19 spinning "heads," sealed in a chamber through which the refrigerator cabinets pass on a conveyor to receive priming and finishing coats. The plastic interior cabinet linings are produced by new deep-draw vacuum moulding machines which "suck" sheets of heated polythene on to metal formers.

The cooling unit section has been completely reorganised, and new plant has been installed for pickling, galvanising, painting and filling in one continuous process. Extensive tests are made for leaks before the units are fitted into the cabinets.

Mechanical handling is used to a considerable extent throughout the factory area, and battery operated trucks are employed for moving materials and parts. Other added facilities include a new technical laboratory and a new drawing office.

Extensions have also been made to the Electrolux cleaner factory, increasing the area from 90,000 sq ft to 110,000 sq ft for a 25% gain in cleaner production.

An assembly line at the Electrolux refrigerator works, Luton. A cabinet sealing test is applied followed by a high voltage insulation test

Design Awards for 1960

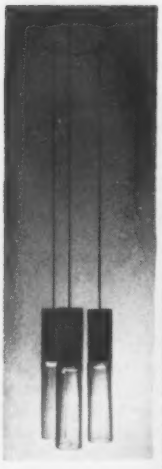
DESIGN Centre Awards for 1960 have been granted to 18 products, three by one electrical manufacturer. The awards are made by a selection panel which at its final meeting sat under the chairmanship of HRH the Duke of Edinburgh. Three lighting units provide the only electrical representation among the successful entries. These are all by Atlas Lighting, and are as follows:

Street lighting columns and lanterns for 15 ft and 20-30 ft mounting, made by Abacus Engineering for Atlas Lighting, and designed by Richard Stevens. The Design Centre comments that the manufacturers have produced two related fittings giving some time between lighting for side streets and main traffic roads.

"Chelsea" range of lighting fittings made by Atlas Lighting and designed by Richard Stevens. A new kind of decorative lighting fitting with the relationship between sharp black metal and thick coloured glass attractive whether the lamps are alight or not.

A low voltage display fitting made by Atlas Lighting and designed by Richard Stevens. A spotlight providing a narrow high-intensity beam without glare.

Thus all the electrical awards go to Atlas Lighting. The supreme award, the Duke of Edinburgh's Prize for Elegant Design, was awarded for a range of dinner, tea and coffee ware. At the Design Centre last Thursday, the Duke of Edinburgh presented his 1959 prize to Mr C. W. F. Longman for his design of the Prestcold "Packaway" refrigerator.



LEFT: Award-winning "Chelsea" range of lighting fittings made by Atlas Lighting

RIGHT: Award-winning street lighting column designed by Richard Stevens and made by Abacus Engineering for Atlas Lighting. This column is in current production for home and export.

CABLES FOR B.R.

WORK has started on a new £150,000 railway cable contract awarded to the AEI Construction (Cables and Lines) Division by the British Transport Commission. The contract covers the supply, supervision of laying, jointing, etc., of some 24 miles of 33 kV 3-core oil-filled cable with aluminium conductors along various sections of the main London to Brighton line, and also the provision of a new 12-core plastics pilot/supervisory cable along most of the route.

Rental Firm Acquired

THE share capital of Brindle and Kirby Ltd., a Prestwich, Manchester, firm which rents and sells radio, TV and electrical appliances, has been acquired for £18,000 cash by Telefusion Ltd.

OFFICIAL PUBLICATIONS

Third Special Report from the Select Committee on Estimates. Session 1959-60. Trunk Roads, DSIR, Nature Conservancy. HMSO. 1s.

NPL Report for 1959. HMSO. 8s.

BS Amendment slips:
52: B.22 Bayonet cap lampholders of moulded insulating material, PD 3724.

BS 3242. Aluminium alloy conductors for o.h. power transmission. 4s 6d.

BS 2901. Filler Rods and Wires for Inert-Gas Arc Welding. Part 2. Wires for Gas-Shielded Metal-Arc Welding. 7s 6d.

BS 3244. Specification for Domestic Pressure Cookers with embedded electric elements. 4s 6d.

Electric Power Situation in Europe in 1958-59 and its Future Prospects. HMSO. 5s.

Report on New Zealand Inter-Island Electric Power Transmission. By the consulting engineers, Preece, Cardew and Rider. Published by NZ Electricity Dept. 3s 6d. (See ELECTRICAL TIMES, 14 and 21 April.)

C.E.G.B. wins £34,500 against Halifax

THE CEGB has won an action against Halifax Corporation in the High Courts of Justice for £34,500 which the board claimed was part of the Corporation Electricity Department's assets. The corporation are considering the question of appeal. At the hearing, Sir Andrew Clark, for the corporation, maintained that the statutory limitation under the 1947 Act barring the board from taking legal action within six years of April, 1948, applied. He submitted that the only question for the court to decide was when the cause of action accrued. The corporation claimed it was 1 April, 1948—11 years before the writ was issued.

For the CEGB Mr H. Willis, Q.C., had submitted that the money was part of a fund accumulated and set aside by the electricity undertaking to meet income tax and excess profits tax. The money should have been transferred on vesting date to the board. In September, 1958, the Minister of Housing and Local Government decided that the moneys were held by the corporation as undertakers. There is no appeal from that decision, and the board claimed £34,500 from the corporation, he went on. Some time in 1947-48 the money in that account was transferred to the income tax suspense account of the general rate fund. That entry was made by the Borough Treasurer on his own authority. The board later found out that that was done without any resolution authorising the transfer.

The corporation maintained that its income tax liabilities were paid out of the general rate fund as a whole, and there was no separate fund for the Electricity Dept., Mr. Willis stated. The board could not take any action to recover the money from the corporation until the Minister had decided whether they were entitled to take the money as an asset, and Mr. Willis submitted that the statutory limitation did not apply.

More on Motorway Lighting

AN official confirmation of the Minister of Transport's attitude towards lighting for Britain's motorways is contained in a report from the House of Commons Select Committee on Estimates published last week. Because the Minister believes that "there is not at present sufficient evidence" to show that motorways should be lighted, he has taken the previously announced decision that the London to Birmingham motorway should remain without lighting. However, future policy is to be decided only after further experience.

New Standards Work

TWO electrical projects are amongst items noted in the current issue of *BSI News* as those on which preparation of new standards has begun. One concerns railway jumper connections. It is intended to produce a standard which will include official dimensions for jumper connections for electric multiple-unit trains, diesel multiple-unit trains and diesel and electric locomotives. The other electrical subject is Tersil-type electric cables for aircraft. The aim is to produce a British Standard to replace Ministry of Aviation specification EL1934. The cables are for circuits with not more than 600 V r.m.s. between conductors, and frequencies not greater than 600 c/s.

EXPLOSION AT BRADFORD

FOLLOWING an explosion at Valley Rd, Bradford, power station last Friday, one man died in hospital and another was seriously burned. We understand that the explosion occurred in the busbar isolator mechanism in No. 4 switchgear room, and burning oil was ejected over the men. Mr R. G. Parr, a shift charge engineer, died later in the day in hospital and Mr J. Kelly, another engineer, was detained there, seriously injured.

The incident occurred at 2.10 a.m. and electricity supplies to the central area of Bradford were restored in about one hour.

Our older readers may recall that Valley Rd power station was the scene of a very serious breakdown in February, 1936, which subsequently had a profound effect on the design of main switchgear. On that occasion the switchroom was wrecked by an explosion in the switchgear, adjudged by Mr H. Nimmo, of the Electricity Commissioners, who conducted an inquiry, to have been due to the failure of an insulator in the current transformer chamber. The explosion and subsequent fire temporarily put out of action 88·5 MW of generating plant, two connections to the grid representing 60 MVA and a large number of important feeders.

Another I.O.M. Station

THE Isle of Man Electricity Board is to establish a new diesel generating station at Ramsey to serve the north of the island. An order has just been placed with the Hawker Siddeley Group for a 2,200 kW Mirrlees engine direct coupled to a 11 kV Brush alternator.

Latest Orders

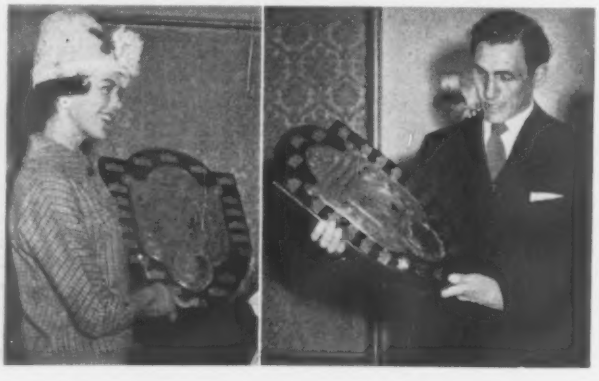
MIRRLEES Bickerton and Day Ltd. have received an order from the Jersey Electricity Co., Channel Islands, for another 3,000 kW diesel generating set.

Admiralty have placed a £64,000 contract with Foster Transformers for 40 self-regulating 500 kVA transformers with Statter circuit-breakers for shore-to-ship supplies in HM Dockyards.

Addressing the Public

MAIN honours in the national finals of the EDA Public Speaking Competition held in London last week went to the South Western Electricity Board, whose representatives won the men's section of the contest and were second in the women's section, and the Yorkshire Electricity Board, who won the women's contest and were third in the men's section.

Miss Valerie M. Hill, a demonstrator in the Rotherham district of the YEB, won the major women's award—the Faraday Silver Challenge—with a speech on "Value for Money." Second place went to Miss Carole A. Hockridge (SWEB), while Miss Gillian P. Dunn (SEB) and Mrs Dorothy Vaughan (SSEB) tied for third place.



Winners of the women's and men's sections of the EDA Public Speaking Competition in the national finals held in London last week— Miss Valerie Hill (Yorkshire Electricity Board) and Mr William A. Wren (South Western Electricity Board).

Winner of the men's shield was Mr William A. Wren, a service centre assistant in charge of the one-man Plympton Service Centre of the SWEB, who spoke on "A Refrigeration Story (Electricity and Health)." Only the week before Mr Wren was runner-up in the West Country Display Challenge Cup contest.

Second place in the men's section went to Mr James F. Grierson (NWEB), and Mr Gordon Oddy (YEB) was third. The awards were presented by Mr J. I. Bernard, director and secretary of EDA, to the men, and by Mr J. A. Stedman, education officer of EDA, to the women.

M.E.M. want Holyhead factory

THE Midland Electric Manufacturing Co. have applied for the tenancy of the Government's "advance" factory at Holyhead, Anglesey. The 28,000 sq ft factory now being built on a four-acre site at Morawelon, near the harbour, is expected to be completed by November. Initially, about 100 workers would be employed but within three years the number could rise to 300. There is also room for doubling the factory size on the existing site.

E.E. in Stafford

THE English Electric Co.'s proposal to build a new £1½ million instrument, meter and relay factory at Stafford has received Ministry approval following a public inquiry. The factory will ultimately employ some 1,600 people.

E.D.A. at Flower Show

THE increasing use of electricity in horticulture will be featured in the Electrical Development Association's exhibit at the Chelsea Flower Show which opens next week (23 to 27 May).

Introductions to the exhibit this year include space heating by a 20 kW fan heater which distributes warm air through the greenhouse via perforated polythene tubes; a cycling thermostat which automatically sets itself to maintain day and night temperatures at predetermined levels; and automatic watering for the commercial grower.

Circuit-breaking reviewed

WORK by the ERA on circuit-breaking is the subject of two articles in the latest issue of *Co-operative Electrical Research*, the house journal of the ERA. In one of these articles, work on conductors is surveyed, with notes on contact wire and welding. In the other, the importance of the current zero period in air-blast circuit-breaker operations is emphasised.

The Young Idea

APPLIANCE QUIZ FOR GLASGOW CHILDREN

Electrical quiz pictures were extremely popular at the South of Scotland Electricity Board's stand at the Schoolboys' Exhibition, Glasgow

OVER 16,000 children took part in an "Electricity Quiz" feature of the South of Scotland Electricity Board at the recent Schoolboys' Exhibition in Glasgow. The children were invited to answer six questions on quiz pictures projected on a screen, varying from a trick picture of an electrical appliance photographed from an unusual angle to questions about electrical terms and consumption of appliances.

For the more serious attention of the secondary school age group, prominence was given to a careers handbook. Another section of the board's stand was devoted to models and illuminated photographs of power stations.

ELECTRIC TRACTION STUDIES

ENROLMENT is now proceeding for the post-graduate course in electric traction which is being developed in the Department of Electrical Engineering of Imperial College, London University, with the support of the BTC and of BEAMA. The course is to run from 4 October, 1960, to 31 July, 1961, and will be open to men with honours degrees in electrical engineering or the equivalent.

The course, which will be under the direction of Professor A. Tustin, will include five basic series of lectures: 26 lectures on fundamentals of electric traction, including economic aspects; 26 lectures on machines and control systems for traction, including auxiliaries; 20 lectures on rectifiers and invertors (both arc and semi-conductor types); 20 lectures on special problems relating to electric traction (power supplies, overhead lines, interference, use of computers, etc.); 10 lectures on railway signalling and communications.

The lecture course will be backed up by laboratory work and lectures will be arranged on special subjects to meet the needs of students.

Besides the post-graduate course leading to the DIC, a research centre is to be established at the college for higher degrees, and a reader in electric traction is to be added to the college's staff in connection with the research programme.

PATTERN FOR POWER

THE story of Britain's integrated electricity supply system is told in everyday language in *Pattern for Power*, a new publication of the Central Electricity Generating Board. This tells how provision is made to meet the minute-to-minute variations of power through a 6,000 mile long grid of high voltage transmission lines. The booklet emphasises the difficulty of reconciling the extension of the grid system with considerations of amenity, and includes the respective figures for costs of undergrounding high voltage lines. These suggest as typical costs for a mile of 275 kV cable, equivalent to the current carrying capacity of a standard heavy-duty double-circuit 275 kV line, the following figures:

Cable	£200,000 per mile
Installation ...	£25,000 per mile
Joints	£35,000 per mile
Excavation and temporary reinstatement	£16,000 per mile
Concrete covers ...	£3,000 per mile
Two sets of sealing ends ...	£27,000
Oil or gas control equipment	£4,000

From the electrical engineer's point of view, a feature of particular interest in the booklet is a list of power stations and grid switching stations arranged in terms of grid control areas.

Oil Contract Outlook

THERE are limits to alterations that can be made to commercial commitments entered into on the scale of the contracts between the CEGB and the oil companies. The oil industry is an international one, so that extensive variations to very large contracts have international repercussions, in which to some extent the good name of the UK is involved. This opinion was expressed by Mr F. H. S. Brown, deputy chairman of the CEGB, in a lecture to the Royal Society of Arts on Monday. Referring to nuclear power in the same part of his lecture, Mr Brown said that although it was marginally uneconomic at the moment, it remained a long-term necessity, for coal could not meet the needs of the future.

Mr Brown included in his lecture the latest figures on station capital cost. For 120 MW reheat units he estimated a station cost of £59/kW s.o., and for a 200 MW unit, £50/kW s.o.

A.E.I. Research at Harlow

THE new laboratories of the Woolwich group of AEI were opened by Lord Chandos, chairman of AEI, last Tuesday. Some 200 scientists in the new buildings will carry out about two-thirds of the group's research activities in collaboration with the Blackheath laboratories, and will be under the direction of Dr M. E. Haine.

Researches in view and on hand include chemical studies of cable insulating materials, chemical analysis by polarography, chromotography, etc., metallurgical studies, electron optics, vacuum physics, phosphors and photoconductors, magnetic materials, transistors and telecommunications.

World Consulting Service

FORMED last January, International Power and Engineering Consultants Ltd. has now also assumed the functions and responsibilities of the BC Engineering Co. and the Vancouver office of Balfour, Beatty and Co. Ltd. The firm can now offer consulting and engineering services in any type of power development, transmission and distribution lines, transport systems, etc., throughout the world.

Courses in Welding

FURTHER courses in welding next autumn are announced by the School of Welding Technology, 54 Princes Gate, S.W.7. The subjects are: Welded Pressure Vessels (26-30 Sept.); Residual Stresses and Stress Relief (10-11 Oct.); Practical Control of Distortion (12-14 Oct.); and Metal Spraying (24-27 Oct.).

Sayings OF THE WEEK

"The oil industry is an international one . . . extensive variations to very large contracts have international repercussions in which to some extent the good name of this country is involved." . . . MR F. H. S. BROWN, deputy chairman, CEGB, in a lecture to the Royal Society of Arts, speaking of the CEGB contracts being renegotiated with the oil industry.

"Prospects in engineering are as good as ever, and with hard work the small firm of today could still be the large firm of tomorrow." . . . MR A. KEATS, chairman of Fisher and Ludlow, speaking at Engineering Industries Association conference.

"In the motor-car industry—one of the most efficient—for every ton of finished motor-car there is a ton of wasted material because of the inaccuracy of the processes. In every foundry, for every ton of finished casting, 100 tons of material is handled between stockyard and fettling shop." . . . SIR JOSIAH ECCLES, Electricity Council deputy chairman, speaking of the opportunities for electricity in industry at EDA annual luncheon

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, May 17

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	244½	−6½
" (3 months)	240½	−4½
LEAD, refined pig, 99·97% purity (cash)	77½	+½
" (3 months)	76½	+½
TIN, refined, min. 99·75% purity (settlement)	785½	+½
(3 months)	785	+1½
ALUMINIUM, ingots 99·99·5% wire bars (4×4×54")	186	—
BRASS Strip 63/37	193½	—
SILVER (Troy oz)	214½	−5
	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	92½	−½
" (3 months)	91½	−½
RUBBER, per lb.		
No. 1, R.S.S. spot	41½d	+½d
c.i.f. basis, ports, July	37½d	+½d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	−½
AMERICAN PRICES:		
Copper, electrolytic (per lb)	33c	—
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

"WHICH?" ON TV SETS

TELEVISION sets provide the main feature in the May issue of *Which?* the monthly publication of the Consumers' Association Ltd. Nineteen models were tested, most of them 17 in. table models with 110° tubes. Criteria in the tests were good quality picture and sound, convenient and easy-to-use controls, safety and ability to stand up to use, and ease of servicing.

The Bush model is given an "excellent" rating for picture quality, and in other sets the rating ranged down to "just acceptable" for a portable model. Two sets received "excellent" ratings for sound quality.

The *Which?* article discusses guarantees and servicing at some length and suggests that wired circuits are far easier to service than printed circuits. It suggests that "the best person to service your set is the retailer from whom you bought it."

Summing up their judgments, the Consumers' Association gives its "best buy" mark to the Bush TV85, with Decca and Murphy sets as "joint next-best buys." No set gave such a poor performance that the Association felt it could not be recommended.

Amongst other subjects in the May issue is that of trading stamps issued by some shopkeepers.

Quiz Final

THE national final of the Electricity Quiz Competition, organised on behalf of the National Union of Townswomen's Guilds by the Electrical Development Association, is to be held at the Royal Albert Hall, London, on 25 May at 7 p.m.

Out of more than 1,000 guilds which competed, four teams have reached the finals. Sir Edwin Herbert, president of EDA, will preside, and the well-known radio and TV personalities Franklin Engelmann and Peter West will act as questionmaster and compere, respectively. Prizes will be presented by Lady Dorothy Macmillan.

E.D.A. Annual Report

IN our summary of the EDA Annual Report last week, we referred in error to "subjects discussed in BEAMA committees." The intention was, of course, to refer to committees of the Electrical Development Association. We apologise for any confusion due to this error.

Author Talking

SOME 120 members and guests at the May luncheon meeting of the Electrical Industries Club in London last week listened raptly to the guest speaker, Mr Russell Braddon, author of best-selling books such as *Cheshire, V.C.*, *The Naked Island*, etc., who gave an Australian view of England, highlighting English eccentricities and (on a more serious note) apathy during election time.

Mr C. Robertson King, immediate past president, once again occupied the chair in the absence of Col B. H. Leeson, the newly elected president, who was unable to be present because of an injury sustained during a fall. The next meeting of the club is on 16 June when the speaker will be Lord Citrine.

News in Brief

The North Western Electricity Board have opened new district offices at Oxford St, Workington.

Ekco-Ensign Electric Ltd. have been granted a British patent under Patent No. 833,412, covering their Essex fluorescent fittings. This covers the basic fitting with its method of mounting the control gear and lampholders, also the attachment of reflectors.

This year's president of the Chartered Institute of Secretaries, Mr E. Long, a member of the CEGB, will address the annual conference of the CIS at Norwich on "Electricity: twelve years of public ownership."

Electricity meters are to be placed on the outside walls of some council houses at Ashover, Derbyshire, so that officials can read them without entering the houses.

The annual cricket match between the ETCTA and the Royal Commercial Travellers' School will be held at Hatch End on 11 June.

Stator of a large G.E.C. Hydro-Alternator

THE CORE OF A FINE MACHINE

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of all types, in all sizes and in all grades of material.

FERROSIL hot-rolled and cold-reduced electrical sheet and strip, and hot-rolled transformer sheet.

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Our Cookley Works is one of the largest in Europe specializing in the manufacture of laminations for the electrical industry.

RTB

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for loads from a few ounces to thousands of pounds

Metalastik bonded-rubber anti-vibration mountings are extensively used in many branches of industry and cover a wide range of applications.

The illustrations show the following:—

1. The smallest METALASTIK INSTRUMOUNTING ($\frac{5}{16}$" body height). For delicate instruments. Loading up to 4 lbs. in compression and up to 1·5 lbs. in shear.
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5. METALASTIK DOUBLE-U-SHEAR MOUNTINGS. A range of all-round utility mountings, simple to fit. Made in four sizes with maximum loadings from 20 lbs., 60 lbs., 160 lbs. and 400 lbs. respectively.
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A descriptive leaflet is available for each type of mounting, which we shall be pleased to forward upon request.

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METALASTIK

Company Activities

BACK came the bargain buyers last week to the Stock Exchange in a bout of renewed optimism which even Mr Krushchev's "might mean war" warning to the US over the shot-down spy incident could not subdue. There were at least half a dozen good reasons why markets generally had to make their recovery. Most investment scribes were unanimous in their penning that an average fall of 13% in share values since January was painting too cautious a picture and this view appeared to be confirmed by Prof E. V. Morgan in a widely publicised broker's circular that the "bear market" may be in the lower half of the down-swing and that now is the time for the long-term investor to buy. With the market short of stock—as it has been for many a month now—statements of this nature invariably provide a price boost. Then there was the report from another Morgan, Sir Frank Morgan, chairman of the "Pru," which showed the company's preference for Ordinary shares during 1959. Of the £104 million of new investments made last year £45 million went into equities—43%—against £21 million or only 26% in the previous year.

News that Manchester Corporation is planning to invest another £500,000 of its superannuation funds through the Stock Exchange within the next three months and a further £400,000 by the end of the financial year in addition to the £3·4 million it has already invested in 173 leading British companies also added its psychological weight to an improving investment sentiment. This was reinforced by the forecast that many more local authorities would follow Manchester's example and that the leaders of two of the country's biggest unions, the National Union of General and Municipal Workers and the NUR, will attempt to talk their delegate conferences into putting some of their funds—their combined assets exceed £10 million—into Ordinary shares.

After this barrage of "bull" points, in came the "big boys," the institutions, with their buying orders to vindicate my own advice that the post-Budget fall in prices had been overdone.

As I predicted, buyers came in for the heavy electricals so that AEI, English Electric, Elliott-Automation, Parsons and GEC all moved higher while Vactric at 32s 3d, Plessey at 47s 9d, EMI at 49s 9d and Radio Rentals at 25s 9d all showed useful gains.

Philips Lamps went further ahead by 3s to 181s 6d on reports from Eindhoven that the group will treble or quadruple its output by 1970. Expansion is expected to be particularly vigorous in South America and in Europe, which with its Common Market comprises a population of some 180 million. The shares seemed a pretty obvious "buy" when I pointed them out last year at around 120s. Sixty-one and a half shillings later my view remains the same. It should be noted that while the UK television market is at about 75% saturation point that of continental Europe is little more than 18%. Philips will have little difficulty in winning this particular "jackpot."

Last week was also notable for good results from Atlas Electric and General Trust, which in the old days before it sold out held interests in South American supply and traction companies. Net revenue for 1959/60 was up from £634,815 in the previous year to £768,961, which enabled a 15% dividend to be paid against the equivalent of 12·7%. Chairman Lord Remnant also proposes to make a one-for-one free scrip issue and to convert the £1 Ordinary shares into 5s shares. Before the announcement the shares had shot up 3s to 83s and went even further ahead to 85s 6d after their publication. A happy omen, let us hope, for electrical investors.—*From our City Correspondent.*

Atlas Electric and General Trust

In addition to increasing the dividend from the equivalent of 12·7% to 15% for the year to 31 March last, it is proposed to capitalise £4½ million from reserves in a 100% scrip issue. Gross investment income for the year amounted to £1,271,313 (*£1,147,913*) and after tax and all charges the net revenue is £768,961 (*£634,815*).

Dictograph Telephones Ltd.

Resolutions to increase the capital to £1 million by the creation of five million new Ordinary 2s shares, and to capitalise £125,000 of general reserve in the issue of 1,250,000 Ordinary in the proportion of one-for-three, were passed at last week's meeting. An interim dividend of 10% is being paid for 1960.

Ever Ready Co. (Gt. Britain) Ltd.

Consolidated profit before tax for year to 27 Feb. increased to £2,735,128, compared with £2,430,553 for the previous year. Taxation charge this time is £1,184,146 (*£1,167,697*) leaving a net profit of £1,550,982 (*£1,262,856*). A final dividend of 15% on the increased Ordinary stock makes 20% for the year, excluding the special interim of 7½% declared in May, 1959. Last year the company effectively paid a rate equivalent to 16½% (including special interim) on the present capital. A surplus of £537,781, from revaluation of a trade investment, is placed to reserve.

Metal Industries

It is planned to raise about £4 million by a rights issue of Ordinary shares. This is intended primarily to replace the bank overdraft arranged during the recent acquisition of Lancashire Dynamo Holdings. In that acquisition the cash part cost some £5½ million, including expenses, but as £2 million was available from short-term investments and other resources, the overdraft amounted to about £3½ million. It is now proposed to increase the authorised capital by £5 million to £15 million by the creation of an additional 1 million £1 shares. The company has at present 1,338,341 unissued £1 shares, part of which will be required to complete the Lancashire Dynamo deal. Afterwards there will be a balance of unissued shares which will be reserved for issue as and when the occasion occurs. A meeting to approve the proposals is called for 30 May.

Power Securities Corporation

The position of development calling for finance in our Colonies is causing us some concern on account of the lack of security of tenure for a sufficient number of years to guarantee the private investor that at least if he does venture into investment he will not lose his capital, Sir Andrew MacTaggart, the chairman, states in his report. Referring to the subsidiaries, Balfour Beatty and Co. had a very active year again, and Duncan Watson (Electrical Engineers) had an increased turnover and a further rise is confidently anticipated for this year. James Kilpatrick and Son are finding contract prices keen, both at home and abroad, and this could lead to lower profit margins. But the orders received in the first quarter of 1960 indicate that turnover this year should be maintained. Sir Andrew also refers to steps taken in connection with Peace River development scheme, Canada (which we have already reported) and states that further shares in that company are to be subscribed for.

Year to 31 Dec.	£ Trading Profit	£ Net Profit*	% on Ord.		Ord. Price	
			Earned	Paid	High	Low
1955	1,093,893	317,861	42	10	47/6	33/-
1956	1,292,203	317,349	37	11	45/-	32/9
1957	1,330,700	369,558	38	11	52/6	40/6
1958	1,525,858	515,438	44	11	49/3	39/9
1959	1,674,746	521,010	41	15	90/6	44/6

* Attributable to parent company.

Simms Motor and Electronics

Profits for the past year improved to £489,490 from the previous year's total of £266,072 after tax. The dividend is raised 2½% to 15% with a final of 10%.

Southern Areas Electric Corpn.

A welcome improvement in the consolidated profit for 1959 is announced. The total is up to £65,691 this time, compared with a previous loss of £3,846 for 1958 when heavy trading losses were incurred by the New Day Electric companies prior to closing down production. Dividends are also resumed with 5%, as against 7½% for 1956.

Yarrow and Co.

It is proposed to capitalise £250,000 of general reserves in a scrip issue of 6½% £1 Cumulative Preference shares on a one-for-three basis.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

19 May—Belfast C.C. Electrical installations in (i) Seaview Primary School alterations and additions; and (ii) rural science greenhouse at Graymount Secondary School for Girls.—See 12 May issue.

20 May—East Riding C.C. Electrical services installation at proposed Filey County Secondary School.—See 12 May issue.

19 May—Ellesmere Port B.C. Contract 298. Provision and erection of 33 concrete Group "A" units.—See 12 May issue.

19 May—Gateshead C.B. Electrical installation in Elgin four-form entry mixed secondary technical school.—See 12 May issue.

20 May—Edinburgh C.C. Supply and installation of passenger lifts in St. Leonard's (Dumbiedykes) comprehensive development area multi-storey flats. Applications to City Architect, City Chmbrs, by above date. Electrical installation in City Chmbrs North West Wing. Applications to City Architect, City Chmbrs, by above date.

20 May—Luton B.C. Rewiring of 90 houses in Corncastle and Hillborough roads and Farley Hill.—See 12 May issue.

20 May—Sedgefield R.D.C. Electrical installations in 76 dwellings on six sites. Applications to Housing Architect, R. Dobson, Council Offices, Sedgefield, Stockton-on-Tees, by above date.

21 May—Staffs C.C. Applications for inclusion in approved list of electrical contractors to County Architect, Green Hall, Lichfield, by above date.

23 May—Cornwall C.C. Electrical installation subcontract in Camborne Fire Station. Applications to County Architect, County Hall, Truro, by above date.

23 May—Dunstable B.C. Supply, erection and bringing into service of 126 sodium and fluorescent Group "A" units on steel columns plus removal of 80 existing m.v. units along A5.—See 12 May issue.

23 May—Ipswich C.B. Erection of 110 Group "A" steel and concrete columns plus provision and erection of 140 and 85 W sodium lanterns, lamps and gear, contract includes provision only of 10 sodium lanterns with gear housed in canopy.—See 12 May issue.

23 May—Londonderry C.C. Electrical installation in Irish Society primary school extension.—See 12 May issue.

24 May—Coulsdon and Purley U.D.C. Provision and erection of 215 Stanton concrete columns together with 140 W sodium lamps and G.E.C. lanterns.—Advertised 5 May issue.

25 May—East Kilbride. (7) Electrical installation work in reconstruction of Ward 23, Hairmyres Hospital. Applications to Group Secretary and Treasurer, Hairmyres Hospital, East Kilbride, by above date.

25 May—Plymouth C.C. Electrical installations renewal, by registered contractors, at Stoke Damerel Primary and Junior School, Somerset Pl, and St. Peter's C.E. School, Wyndham Sq. City Engineer and Surveyor, J. Ackroyd, The Guildhall. Deposit £3 3s.

26 May—Belfast C.C. Supply and installation of electric lift.—See 12 May issue.

27 May—Belfast C.C. (a) Supply of sodium vapour lanterns, brackets and standards (spec. W.176); supply and installation of (b) p.a. and sound reproduction equipment at Floral Hall, Hazelwood; (c) communal aerial system Parkmount flats, Shore Rd.—See 12 May issue.

27 May—Cardiff C.C. Electrical installation on fixed price basis in proposed Subdivisional Police Station, Ely. City Surveyor, City Hall. Deposit £2 2s.

27 May—Larne B.C. Electrical installations in four shops and maisonnettes on Antiville site. Housing consultant: T. J. M. Davison, 47 Station Rd, Larne.

27 May—Middlesbrough C.B. Supply of (item 53) lamps.—See 12 May issue.

27 May—Spenborough B.C. Supply and erection of 356 Group "B" prestressed spun concrete lighting columns complete with lanterns, lamps, control gear and wiring. Borough Engineer, Town Hall, Cleckheaton. Deposit £2 2s.

30 May—Carlisle C.C. Supply, erection and wiring of 29 Group "A" and 59 Group "B" concrete columns, lanterns and ancillaries, being Stage 3—Morton St lighting.—See 5 May issue.

30 May—Dearne U.D.C. Rewiring of 60 houses on Carby Hall estate.—See 12 May issue.

30 May—Kidderminster B.C. Erection and wiring of 1,000 Group "B" concrete lighting columns. Borough Engineer and Surveyor, 110 Mill St. Deposit £2.

30 May—Littleborough U.D.C. Supply, erection and putting into operation of 18 Group "A" concrete columns with 85 W sodium discharge lanterns, lamps and auxiliary gear.—See 5 May issue.

30 May—New Windsor T.C. Erection of Group "B" prestressed spun concrete columns, fitting lanterns and lamps and wiring. Borough Engineer, Kipling Memorial Bldg, Alma Rd, Windsor.

30 May—Stepney B.C. Two passenger lifts for nine-storey block of flats. Details from Ritches and Blythin, 16 Northumberland Ave, W.C.2. Deposit £2 2s, made payable to B.C.—Advertised in this issue.

30 May—Stockport B.C. Electrical installations in 61 dwellings, York St, Contract 4.—See 12 May issue.

30 May—West Riding C.C. Rewiring work at (contract 2) Thrybegh, St. Gerards R.C. (Aided) School; (contract 4) Pudsey, Waterloo J.M. School; (contract 5) Hoyland, West St Infants' School. Applications to: (contract 2) Divisional Architect, Planet Rd, Adwick-le-Street; (contract 4) Divisional Architect, Salisbury Bldgs, Albert St, Harrogate; (contract 5) Divisional Architect, Flint St, Huddersfield, by above date.

31 May—Cardiff C.C. Electrical installations, on fixed price basis, in two playrooms at Preswylfa Occupational Training Centre, Canton. City Surveyor, City Hall. Deposit £2 2s.

31 May—Ealing B.C. Contract A: Supply of 41 140 W sodium lanterns, lamps and gear. Contract B: Supply and erection of 41 25 ft steel columns.—Advertised 5 May issue.

31 May—Hetton U.D.C. Supply of (Item 10) electrical equipment and (Item 16) lamps for year to 31 March, 1961. Engineer and Surveyor, Hetton Hse, Hetton-le-Hole.

31 May—Lytham St. Annes B.C. Supply, erection and wiring of 87 Group "A" and 44 Group "B" "Stanton" concrete columns complete with control gear plus the removal of 113 existing columns.—See 12 May issue.

31 May—Wanstead and Woodford B.C. Installation of 685 Groups "A" and "B" lighting units of various types in 120 roads.—Advertised 12 May issue.

1 June—Luton B.C. Electrical work in connection with new heating installation at Dunstable Rd primary schools.—See 12 May issue.

1 June—Melton Mowbray U.D.C. Supply and installation of a storm pump, 3,120 g.p.m. against a 177 ft head; sewage pumps, 1,560 g.p.m. against a 77 ft head; and standby 780 g.p.m. at a 64 ft head together with two sludge pumps.—See 12 May issue.

2 June—Armagh. Electrical installations in 40 dwellings, Callan St. N.I. Housing Trust, 12 Hope St, Belfast 12.

2 June—Belfast. Electrical installations in extensions and new meals servery at St. Peter's Voluntary Primary School, Raglan St. Details from architects, McLean and Forte, 37 Malone Rd, Belfast. Deposit £1 1s.

3 June—Bognor Regis U.D.C. Supply and erection of 174 Stanton, Concrete Utilities and G.E.C. columns; supply, fitting and wiring of G.E.C. fluorescent lanterns complete with auxiliary gear plus removal of existing installations. Engineer and Surveyor's Dept., Town Hall. Deposit £2 2s.

3 June—Londonderry R.D.C. Supply and installation of 150 g.p.m. at an 80 ft head centrifugal or submersible pumping plant at Kilcaltan.—See 5 May issue.

3 June—Notts C.C. Supply and erection of 10 steel columns, lanterns and gear on A1 at Hawk's Nest, Bawtry.—Advertised 12 May issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Gaygrip" holloware—makers of? E.C.—Hague and McKenzie Ltd., Pyramid Wks, Sloane St, Birmingham.

"Polimop" floor polishers—suppliers of? M.A.N.W.E.B.—A. F. Jeffree Ltd., 8 Doversgreen Rd, Reigate, Surrey.

"Don-Handy" toasters—address for? S.E.B.—New Forest Services (Lyndhurst) Ltd., High St, Lyndhurst, Hants.

"Power Master" refrigerators—address for spares? L.E.B.—Raymond Ball (Shirley) Ltd., 826 Wickham Rd, Shirley, Croydon, Surrey.

"Elna" sewing machines—agents for? T.E.—Leighton Baldwin (Sales) Ltd., 365 Euston Rd, N.W.1.

"Magimix" food mixers—suppliers of? G.H.—Keith Lowe Engineers (Dudley) Ltd., King St, Dudley, Worcs.

"Nelson" bandit alarm systems—makers of? E.E.W.—Carter and Co. (Nelson) Ltd., William St, Nelson, Lancs.

Baby alarm systems—makers of? H.H.L.—Hifi Ltd., Derry Wks, Brierley Hill, Staffs; Defesco Sound Equipment Ltd., 25 Lansdowne Rd, E.4; Easco Electrical (H) Ltd., 6/8 Brighton Terr, S.W.9; General Electric Co. Ltd., Radio Dept., Magnet Hse, Kingsway, W.C.2.

FURTHER ANSWER

"Hilti" fastening tools—address for? E.D.A.—Ucan Development Ltd., 62 Hill St, Richmond, Surrey.

7 June—Sligo C.C. Supply and erection of 128 g.p.m. at a 142 ft head pumping plant at Lower Rosses.—See 12 May issue.

8 June—Winchester C.C. Erection complete of 50 25 ft steel and 16 ft c.i. columns for 250 W, 120 W and 80 W colour corrected m.v. lighting along A31 and C461. City Engineer and Surveyor, Guildhall. Deposit £2 2s.

9 June—Liverpool Hospital Management Committee. Provision of new road lighting at Sefton General Hospital. Secretary, Garnet Chaplin, Sefton General Hospital, Liverpool 19.

10 June—Aldridge U.D.C. Erection of: (1) 12 Group "A" and 44 Group "B" reinforced concrete columns and supply/erection of 12 140 W and 19 60 W sodium lanterns and gear and 25 100 W tungsten lamps, lanterns; (2) 43 Group "B" columns plus supply/erection of 35 60 W sodium lanterns/gear and eight 100 W tungsten lamps/lanterns on fixed price basis.—See 12 May issue

11 June—Chesham U.D.C. Supply and erection of 49 Group "A" steel columns with 250 W colour corrected m.v. lanterns together with 24 Group "B" columns with 125 W m.v. lanterns with all lamps and control gear. Engineer and Surveyor.—Advertised in this issue.

16 June—Llanfrechfa Lower P.C. Supply and erection of 49 Group "A" steel columns with 140 W sodium lanterns, ancillary gear and underground cabling. Alternatively: 38 35 ft steel columns with 200 W sodium lanterns for A4042 lighting at Croesyceiliog. Details from consulting engineers, Thomas and Morgan and Partners, 23 Gelliwastad Rd, Pontypridd, Glam.

22 June—Stockport B.C. Electrical installation in "Newlands," Aged Persons' Home.—See 12 May issue.

No date stated—Burnley C.B. Supply of 140 W lamps, lanterns, transformers, condensers, 25 ft steel columns, time switches, underground and lighting cables.—Advertised 28 April issue.

Gazette Announcements

COMPANIES ACTS

Loughton Radio and Electrical Co. Ltd. Creditors to send details to liquidator: L. J. W. Gould, 88 Leadenhall St, E.C.3, by 27 May. Formal notice: all known creditors have or will be paid in full.

Senior Installation and Maintenance Ltd. Petition for winding-up to be heard before the Cardiff County Court on 22 June. Persons intending to appear to notify Athan Morgan and Shibko, 5 Dumfries Pl, Cardiff, by 6 p.m., 21 June.

Faith Electrics Ltd. Mr M. R. Frankel, 13 Park Pl, St. James's, S.W.1, appointed liquidator at extraordinary general meeting on 4 April for the purpose of voluntarily winding-up.

T. S. Skillman and Co. Ltd. General meeting to be held at 1-2 Milk St, E.C.2, on 27 May, at 11 a.m., for the purpose of having an account laid before the members.

Brown and Hicks (Electrical) Ltd. Petition for winding-up to be heard before the Royal Courts of Justice, Strand, on 23 May. Persons intending to appear to notify Cochrane and Cripwell, 119 Finsbury Pavement, E.C.2, by 1 p.m., 21 May.

Ero Condenser Co. Ltd. Mr J. L. Guy, 15 Cullum St, Fenchurch St, E.C.3, was appointed liquidator at extraordinary general meeting on 4 May. Creditors to send details to liquidator by 25 May.

South Wales Electrical Engrs. Ltd. Last day for receiving proofs for intended dividend: 23 May, to liquidator: G. H. Down, 106 Walter Rd, Swansea.

Northern Infra-red Mnfg. Co. Ltd. Creditors to send details to liquidator: A. T. Eaves, 47 Mosley St, Manchester 2, by 7 June.

BANKRUPTCY ACTS

Public Examinations

Dudley. J. E. White, electrical engineer, carrying on business as Woodall and White and as Electraders, at 42 Lawrence La, Old Hill. Public examination: 11 a.m., 16 June, at Court Hse, Priory St, Dudley.

Southend. K. G. Richards, dealer in domestic appliances, trading with another as Southern Electrical Appliances, of 21 Redcliff Drive, Leigh-on-Sea, and lately at Warrior Hse, Warrior Sq, Southend. Public examination: 11 a.m., 5 July, at 102 Alexandra Rd, Southend.

Receiving Orders

Newport and Ryde. J. R. Marsh and A. H. Percival, electrical dealers and contractors, carrying on business as A. H. Percival and Co., at 13 and 14 Spencer Rd, Ryde. Receiving orders dated 10 May.

Intended Dividends

Rochester. C. E. Purcell, electrical contractor, carrying on business as Edward Purcell and Sons, at 13 Wrotham Rd, Gravesend. Last day for receiving proofs for intended dividend: 25 May, to trustee: T. A. Tuck, 40 St. Margaret's St, Rochester.

Liverpool. G. Dickinson and K. G. Dickinson, carrying on business as G. and K. G. Dickinson, at 134 Clipsley La, and 321 Church Rd, Haydock. Last day for receiving proofs for intended dividend: 25 May, to trustee: H. S. Oliver, 5 Rumford Pl, Liverpool 3.

Application for Discharge

Bournemouth. C. W. Hales, electrical engineer, lately carrying on business at 2 Lake Rd, Hamworthy, Poole, Dorset. Order made on application for discharge on 6 April: discharged as from 6 Jan., 1961.

Release of Trustee

Wandsworth. W. A. Carter, electrical engineer, lately carrying on business at 95 Hambalt Rd, S.W.4. Trustee: W. J. W. Hill, 58/61 York Terr, N.W.1, released as from 26 April.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

1 June—Ceylon. 25 miles 7/·081, 25 miles 7/·102 and 50 miles 7/·110 all aluminium conductors and accessories; five 33 kV circuit-breakers, c.t.'s, 33 kV/110 V transformers and sheet steel instrument panels. Crown Agents, 4 Millbank, S.W.1. B.o.T. (ESB/11659 and 61/60).*

1 June—S. Africa. 30 klb/hr 2 MW steam turbine generator set for Village Council of Tzaneen Electricity Undertaking. Consulting engineer: Ian Drewett, 17 Harrison St, Johannesburg. B.o.T. (ESB/11476 and 7/60).*

2 June—Burma. 300 coils of 100 yd 3/·036 lead covered cable. Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/12933/60).*

3 June—India. 70,000 l.t. insulators. Stores Purchase Officer, H. K. Beher, Rajasthan State Electricity Board, Power Hse, Jaipur. B.o.T. (ESB/12942/60).*

4 June—Costa Rica. Supplies list including lamps, starters, insulators, switches and fuses. Departmento de Licitaciones Publicas, La Proveeduria Nacional, San Jose. B.o.T. (ESB/12422/60).*

8 June—India. 158 transformers from 25 to 100 kVA. Stores Purchase Officer, H. K. Beher, Rajasthan State Electricity Board, Power Hse, Jaipur. B.o.T. (ESB/12062/60).*

15 June—Nepal. 500 kW plant for Pokhara Phewatal Hydro Project. Applications for details, fee Rs.5, to Office of Chief Engineer, Electricity Dept., H.M. Government, Kathmandu, by above date.

16 June—Ceylon. Service cut-outs, l.t. circuit-breakers, 11 and 33 kV switchfuses, gang operated air-break switches. Crown Agents, 4 Millbank, S.W.1. B.o.T. (ESB/12008/60).*

22 June—Nigeria. One l.t. 15 MVA six-panel switchboard and one 10-panel switchfuse board. Details from the Resident Engineer, E.C. of Nigeria, John Adam St, W.C.2.—Advertised in this issue.

7 July—India. Power cable, 21 items, and control cable, 65 items. Superintending Engineer, Technical (Electrical), Madras State Electricity Board, 157 Mount Rd, Madras 2. B.o.T. (ESB/12415/60).*

TRADE NOTES

Change of Address. As from 23 May, the address of Burton, Griffiths and Co. Ltd. (B.S.A. Tools Division), now at 93 Albert Embankment, will be 54 St. James's St, S.W.1. Telephone: Hyde Park 3575.

Concerning our note last week on the move of S.L.R. Electric Ltd. we were wrongly informed, and while the sales and showroom will be at Welbeck Works, South Harrow, the head office is to be located at the new factory at Cranborne Rd Industrial Estate, Potters Bar.

Dulrae Ltd. have moved to new and larger premises at Spur Rd, North Feltham Trading Estate, Feltham, Middx. Telephone: Feltham 5052.

Beama Contract Price Adjustment Formulae. *For Electrical Machinery and Equipment.* For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 May, 1960, shall be deemed to be 204s 6d; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 13 May, 1960, is 116·9* (181·3*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 13 May, 1960, shall be deemed to be 204s 6d; (*b*) "Cost of Material"—the index figure for Materials used in the Mechanical Engineering Industry at 13 May is 126·1* (189·5*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)." 188·2*. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2), 128·2*. The price of brass condenser tubes ¼ in. o/d 18 s.w.g. on 13 May, 1960, is 4s 1¼d per lb. *Provisional figure.

The figures in parentheses shown above relate to the earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954 = 100.

Change of Telephone No.: Winn and Coales Ltd., Denso Hse, Chapel Rd, S.E.27, announce the change of their telephone number to GIPsy Hill 7511.

New Factory. Simplex Dairy Equipment Co. Ltd., a subsidiary of the General Electric Co. Ltd., is shortly to move into its new factory at Sawston, near Cambridge.

New Sales Office. Polypenco Ltd. have opened a new sales office at 117 Swan Arcade, Bradford 1.

Agency. Chrysler International S.A. have appointed J. Raven Ltd., 43 London Rd, Twickenham, as sole London distributors for Airtemp air conditioning room units.

BUSINESS PROSPECTS

Ashington. R. Carse and Son, Prospect Rd, Amble, contractors for three-storey ward block, Ashington Hospital.

Barrow-in-Furness. Zenith Carburettor Co., Honeypot La, Stanmore, Middx, plan Park Rd factory.

Birkenhead. Health Comm. plan residential hostel for mental health service.

Birmingham T.C. Tender: 4 Windsor St shop/dwellings, 20 Handsworth dwellings and 26 Harborne dwellings. Architect.—W. G. Howell, 82 South Hill Pk, London N.W.3, architects for University's seven- and two-storey Faculty of Commerce and Social Science, for 490 students.

Bournemouth. Mr B. Pinn plans five-storey offices, 20 Exeter Rd.—Stanbourne Motors plan five-storey offices with 24 flats, showrooms and petrol station, Poole Rd.

Bradford T.C. Tender: 24 Westfield La bungalows. Engineer.—£586,790 extension, scheme, Technical Coll. planned. Architect.

Brentford. Firestone Tyre and Rubber Co., Gt. West Rd, plan modernisation.

Brentwood. Daniel T. Jackson Ltd. plan 250 Shenfield houses. Roebuck Rd, Ilford.

Buntingford. J. Sainsbury, Stamford St, S.E.1, plan factory premises.

Cannock. National Coal Board, Allport St, plan Bridgtown Miners' Hostel admin. centre, laboratories and canteen.

Carlisle. John Twiname, Brigham, contractor for C.C.'s 100 Morton estate houses.

Chelmsford. J. Camper and Son, 87 Rainsford Rd, to rebuild joinery work.—Rich and Ferguson, 124 London Rd, architect for Eytor Lense Mnfrs. extensions, Legg St.

Cheltenham. Spirax-Sarco, Charlton Hse, plan 3,750 sq ft premises extensions.

Chertsey U.D.C. Tender: 10 houses, Broomfield Rd and Fordwater Rd. Engineer.

Chester T.C. Thomas and Evans, Hannah St, Porth, S. Wales; Aston Artificial Stone Co., Sealand Rd, Chester; and Central Flooring (Stoke), 10 William Clowes St, Burslem, Stoke-on-Trent, plan Sealand Trading Estate industrial developments.

Corsham. Altus Engineering Co. plan Stokes Rd factory/office extensions.

Coventry. Birmingham Regional Hospital Board plan phase 4 of Coventry and Warwickshire Hospital at Stoney Stanton Rd.—Also Fletchamstead Hall Farmhouse site planned for mental patient hostel.—Planned at Torrington Ave: Factory/offices for Middlemore (Coventry), factory extensions for Torrington Co., chemical plant for Hard Metal Tools and factory extensions for Sargison Bros.

Cranbrook R.D.C. Tender: Blocks of 10 and four two-storey flats, Red Oak estate. Architect.

Crawley. S.W. Metropolitan Regional Hospital Board plan £188,500 nurses and £56,000 staff accommodation, Crawley Hospital.

Darlington. Gillinson and Barnet, 6 Queen Sq, Leeds, architects for Shop Construction Group's Northgate/Albion St shops.—Douglas J. Oliver and Ptnrs, 10 St. Matthews Sq, Rugby, architects for 25 Salters La houses, Kingsway Housing Assn.

Dartford. Illinois Stoker and Combustion Co. plan Princes Rd extensions.—Wellcome Foundation plan Temple Hill chemical works.

Darwen. £95,000 R.C. school planned, Birch Hall Ave.

Devonshire C.C. Tender: Kitchen, etc., Exminster Primary School. Architect.

Dover. London Fancy Box Co., Granville St, plan 13,000 sq ft extensions.

Dunstable. R. Holton, 9 St. Stephen's Cl. Ave Rd, N.W.8, plans shops and offices.—Investment Properties, Luton Rd, plan factory extensions.

Durham. Gradon and Son, North Rd, contractors for C.C.'s £12,616 Brandon nursery.—C.C. Tender: Stage two Easington Technical College, Architect.

East Suffolk C.C. Tender: 5,000 sq ft extensions, County Hall, Ipswich. Architect.

Eastbourne. A. F. Myers and Ptnrs, 147 Victoria St, S.W.1, electrical consultants for Corporation's planned concert hall.

Edenbridge. G. Lower and Ptnrs, 4 High St, Croydon, architects for hospital boiler house.

Felling. C.W.S., 90 Westmorland Rd, Newcastle, plan Carr Hill Rd shop premises. Own architects.

Gillingham B.C. Tender: 20 houses, Rainham.—Tender: 62 Twydall Hawthorne estate flats. Borough Engineer.

Hainault. 27 houses and garages planned on three sites. £78,100.

Havant. Marsh Plant and Machinery Co., 23 South St, Emsworth, plan New La workshop and offices.

Hull. Weeks and Co. (Engineers) plan Oxford St factory.—Reckitt and Sons, Dansom La, plan multi-storey building, Kinston Wks.—L.S.D. Transport (1944), Neap Hse, Gunness, Scunthorpe, have lease for Clough Rd site.

Lancs C.C. Tender: Six-bay ambulance station, Kirkby. Architect, Preston.

Larne. East Antrim Hospital Management Comm. plan £100,000 Moyle Hospital extension.

Lewes. Stone and Son, Hove, Sussex, contractor for R. J. Everett and Co. £24,000 extensions.

Liverpool. M. Greenberg and Sons, 80 Prescot Rd, plan additional premises.—Henry Diaper and Co., King Edward St, plan Kirkby Industrial Estate construction.

London. Adcola Products Ltd., Gauden Rd, S.W.4, plan warehouse-offices.—Brookes Crystals, Lassell St, S.E.10, plan extensions. Enterprise Aluminium Foundry, Norman Rd.—S.W. Metropolitan Regional Hospital Board plan stage two of St. Stephen's Hospital's £292,050 development; £116,878 Lambeth Hospital stage one planned.—Devereux and Davis, 3 Gower St, W.C.1, architects for Westminster Bridge Rd office block.—Token Construction Co., 68 Mount St, W.1, to rebuild Army and Navy Club, Pall Mall.—Farring Developments plan 17-storey offices, High Rd, Whetstone, N.—George Davies and Webb, 112 Jermyn St, S.W.1, architects for Winkfield Estates Ltd. 33-storey office block, six-storey maisonnette block at Lambeth Rd.—Salter and Andrews, 31 Throgmorton St, E.C.2, surveyors for Mecca storage building, 87 Newington Causeway, S.E.1.—L. A. Culliford and Ptnrs, 47 Essex St, W.C.2, architects for Cornwall Press Paris Gdns alterations.—E. Hill and Ptnrs plan five-storey Southward St building.—Knapton and Dean, 6 Martin La, E.C.4, architects for four-storey Borough Rd office block, Bernard Sunley Investments.—Vigers and Co., 4 Fredericks Pl, E.C.2, architects for Old Kent Rd and Old Kent Rd flats.

Luton. Harold Davison Ltd., 29 Regent St, W.1, plan Alma St shop/restaurant/ballroom/office building.

Maltby. Simpson and Rollstone, Wigston, Leicester, contractors for D. Byford and Co. £28,867 Rotherham Rd extensions.

Manchester. Plewin Properties Investments plan Deansgate shops and offices.—T.C. £63,650 Roundthorn factories and £26,250 factory, Wythenshawe.

Middlesbrough B.C. Tender: 59 Easterside houses, 36 St. Hilda's flats. Engineer.

Mitcham. Transcription Manufacturing and Recording Co., 132 Western Rd, plan 16,600 sq ft extensions.

Morpeth. Enlargement for 800 beds at Northgate Hospital for Regional Board.

Newburn. Tender: £200,000 Stanners Industrial Estate factory for Aveling-Barford, Grantham, Lincs.

Newcastle. Tender: Stage two of Prudhoe and Monkton Hospital major expansion scheme. Secretary of Regional Hospital Board, Benfield Rd, Newcastle 6.—£250,000 five-home scheme planned by Welfare Committee.—Cackett, Burns Dick and MacKellar, 21 Ellison Pl, architects for lifts and extensions to Newcastle Co-op. Society, Grainger St.

Newport. Governors of Harper Adams Agricultural College plan £250,000 extensions.

Northumberland. £13,000 Brunton Pk children's centre planned. Architect.

Port Glasgow. Factories planned for industrial estate. Playtex International Laytex Corpn., £215,000; and £152,085, Aircraft-Marine Products (Great Britain).

Prescot U.D.C. Tender: 62 houses, 68 maisonnettes, Elm Hse site. Architects: Gornall, Kelley and Ptnrs, 155 The Albany, Old Hall St, Liverpool 3.

Rotherham. Rotherham Forge and Rolling Mills plan Greasborough St works extensions.—Slag Reduction Co. plan Templeborough Wks extensions.

Rugby B.C. Tender: 16 Abbots Farm estate two-storey flats. Surveyor.

S. Shields. Murray Hearne and A. I. Surtees plan factories in Maxwell St.—J. Cummings, Matamba Terr, Sunderland, contractor for S. Newman Ltd. Commercial Rd clothing factory.

S. Wales. Pyrene Co. Ltd., Gt. West Rd, Brentford, Middx, plan purchase of factory to install £362,000 plant.

Salford T.C. Tender: Phase 2, Cromwell Sec. Mod. School. Architects: Cruickshank and Seward, 196 Deansgate, Manchester.

St. Austell U.D.C. £75,000 civic hall planned.

Stockton-on-Tees. T.C. Tenders soon: 16 Hardwick houses. Borough Architect.—Alison and Hutchison, 4 Rothsay Terr, Edinburgh, architects for £1 million Hardwick hospital for Newcastle Hospital Board.—Ideal Builders (Stockton), 76 Hartburn Ave, contractors for 16 Crook St area houses. T.C. Tenders soon for £61,000 Blue Hall estate house improvement scheme.—£7,000 Emmanuel St workshop offices planned by Hulla and Co., Grey St, Stockton-on-Tees.

Sutton and Cheam. Dawson-Keith plan Hillview Rd industrial buildings.

Swindon. Multi-story Penhill, Walcot and Park North flats in new programme.

Truro R.D.C. Tender: 28 houses, various sites. J. H. Snellgrove, 47 Coinaghall St, Helston, quantity surveyors.

Tyrone C.C. £100,000 Omagh home planned.

Wandsworth. C. E. Culpin, 39 Doughty St, W.C.1, architect for £790,800 Edgcumbe Hall site development plan for 54 houses, 68 maisonnettes, 154 flats and 32 dwellings for aged.

Watford. Holywell Industrial Estate flatted factory proposed for plot 10.

Wessex. Regional Hospital Board, Highcroft Rd, Winchester, plans £17 million 12-year construction scheme, including rebuilding of Old Manor Hospital, Salisbury, £1,700,000.

West Bromwich. Smith and Davies plan Friar Pk Rd factory. Hurley Robinson and Sons, 6 Cherry St, Birmingham 2, architects for two-storey block for Dart Spring Co.—Synthite Ltd. plan Ryders Green Rd laboratory, etc.

West Kesteven R.D.C. Tender: 14 bungalows on three sites. Surveyor.

West Suffolk C.C. Tender: 12,000 sq ft alterations, King Edward VI school, Bury St. Edmunds. Architect.

Woolwich. £90,640 school, Rose Cottage, planned for delicate children.

Worcester. £224,000 swimming facilities scheme planned for Sansome Walk.

Worksop B.C. Tender: 14 Kilton Hill estate houses. Engineer.—R.D.C. Tender: 22 houses on five adjacent sites. Carlton-in-Lindrick. Architect: B. D. Thompson, 102 Bridge St.

Company Meeting

Enfield Rolling Mills Limited

Results Better Than Expected

THE EARL OF VERULAM'S STATEMENT

THE Thirty-sixth Annual General Meeting of Enfield Rolling Mills Ltd. was held on 18 May at Enfield, The Rt Hon The Earl of Verulam (chairman) presiding.

The following are extracts from the chairman's statement which had been circulated with the report and accounts for the year ended 31 Dec., 1959:

A year ago I stressed that a check to our rate of progress appeared inevitable in 1959, for a number of reasons. The results that we are now able to show are appreciably better than expected. As last year, I comment upon them factory by factory.

The Brimsdown Factories

ENFIELD CABLES LTD.: Our reasons for the purchase of this Company were fully explained in my circular of 14 May, 1959; they were, in the main, defensive. Enfield Cables' trading results in recent years had not been good. On 1 May, 1959, a price war had broken out in the cable industry, with the outcome that prices had fallen to completely uneconomic levels. Our offer for Enfield Cables' shares became unconditional on 12 June, 1959. Immediately thereafter most energetic steps were taken to reduce unnecessary expenditure all round, to combine services common to both the parent company and Enfield Cables, to obtain a full order book, to widen the range of products manufactured, and to install systems of costing, plant maintenance, marketing, etc., on the same lines as those that the Parent Company operates.

In my circular of 23 Nov., 1959, I described how Enfield Cables proposed to sell its power cable business to Enfield-Standard Power Cables Ltd., a new company in which we retain 50% of the equity. The new company started trading on 1 Jan., 1960.

We are very much encouraged by the reception which the company has met from the whole industry and by the vigour with which the directors of our partners, Standard Telephones and Cables Ltd., are working for its future.

The activities of Enfield Cables which have not been passed over to E-SPC comprise the sale of copper wire, covered conductors, cable accessories, etc., both at home and abroad, as well as the sale of all products (including cables) through its overseas subsidiaries. In addition Enfield Cables will continue to own the land and buildings at Brimsdown, which have been leased to E-SPC.

ENFIELD COPPER REFINING CO. LTD.: We had another good year in the Copper Refinery, with no special problems that I need mention.

Sales of *Encon* continuously cast bronze again increased and, at the end of the year, the extension of this plant was under active review.

The Electrodes Department had another good year. The incorporation of Enfield Cables' Cable Accessories Works at Tottenham into ERM will still further enable us to improve on our production and sales service.

COPPER ROD MILL: As I said 12 months ago, our Rod Mill was experiencing a lower demand at the time than for many years, due to re-grouping amongst our former customers in the electric cable industry. Uncertainty regarding possible export sales delayed our giving effect to a decision to install extensive further mechanisation. This work was accordingly only started in April, but was carried through very smoothly. In the result we are now able to produce either very large tonnages of rod from the Mill in its previous form or much smaller tonnages in its modified form, at approximately equal labour cost per ton in either condition. Domestic demand has improved over the year and, with some revival in the export field, we ended the year at a very satisfactory level.

DRAWING MILL: The transference of work to the new copper drawing bays was completed during the year, just in time to take advantage of a considerable increase in demand which became apparent in December. Reshuffling of plant and processes on this scale inevitably reduced the department's profit, but it is at present poised to benefit from these changes, at a time when the extra capacity now available seems to be required by our customers.

SHEET MILL: This was another very good year in which our customers were active in all branches. The motor industry, in particular, reached record levels of demand and we are continuing to make available capacity to meet its tremendous expansion plans for the future.

LONDON ZINC MILLS LTD.: Another successful year. In certain lines demand grew right up to our productive capacity. Balancing additional plant is being ordered.

ENFIELD ROLLING MILLS (ALUMINIUM) LTD.: The expansion of our sales in 1959, to which I looked forward last year, has materialised and we are again in the process of expanding capacity, to enable Brimsdown and Bradford to meet yet higher demands in the future. Important expansions were also made during the year, including the concentration of the whole of our impact extrusion plant in a new factory at Brimsdown.

Further important additions to our rolling capacity have been completed and some re-allocation of plant between Brimsdown and Bradford is going on, to reduce unnecessary transport between the two works.

Other Factories

THE ASTON CHAIN AND HOOK CO. LTD.: Demand from the motor industry has been at record levels. The new Brass Strip Mill was completed, nearly on schedule. Teething problems, inevitable with such plant, occupied several months. Raw material supplies to the mill have been difficult. Plans due to mature early in 1960 should overcome both these problems.

Aston Chain and Hook's subsidiary company, Carridine and Miles Ltd., who previously occupied leasehold property, were moved into the main works at Birmingham during the year. This will lead to economies and greater efficiency in the future.

BARKER AND ALLEN LTD.: With its subsidiaries, Barker and Allen Ltd. became part of the Group in May, 1959, on terms which were set out in my letter dated 14 April, 1959, to Stockholders. The business is complementary to that of the parent company, with only a very small area of overlapping. The integration of Barker and Allen Ltd., therefore, with the parent company, presented few difficulties. Barker and Allen had a very successful year, in line with their results of recent years, but the figures incorporated in our accounts cover less than a full year. Considerable work has proceeded, and is in hand, on plant and process rearrangement. This will result in greater economy, through fewer manufacturing units and less inter-factory transport.

ENFIELD ZINC PRODUCTS LTD.: The rate of decline in demand for zinc cans has not accelerated, though the absolute level is not good. Export prices fell even further during the year, but seem now to be improving slightly, as our foreign competitors become aware that we are not going to be forced out of any market.

Production space at our Tottenham factory, no longer required for zinc cans, is being made available to other parts of our Group for profitable use.

HOLLOWAY METAL ROOFS LTD.: A very active year with a much better order book at the end of the year than at the beginning. Demand seems to be very good at the moment.

W. E. MARTIN AND CO. LTD.: This business has had its best year, so far, with a very high level of activity, particularly in the field of domestic equipment. Mr F. Boardman, one of the original directors of the company, has continued with us since we purchased the business and has retired, at his own request, early in 1960.

WATLIFF CO. LTD.: This company has had a much better year than 1958. Developments in the Outer Seven Free Trade Area will need very close watching. An intensive study of foreign costs and prices, compared with our own, is under way.

Prospects

We have begun 1960, so far, with an even better level of demand than in 1959. I therefore remain confident that we shall secure at least the same share of future business as we have been doing in the past. As each year passes the results of our efforts have been not only to broaden the basis of our operations but also to found them more securely. Given stable conditions, and arising from them the continued prosperity of our customers, I continue to view the future with confidence.

The report and accounts were adopted.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Battersea Electronic Tubes Ltd., 8 High St, Sidcup, Kent. Nom. cap.: £100. Dirs.: William H. Barnes and David M. S. Toms.

Brian and Rogers Ltd., 46/7 Chancery La, W.C.2. Electrical engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: to be appointed by subs. Subs.: Cyril P. Baxter and Norman R. Loveday.

Burnley Electrical Sales Ltd., 44 Hebrew Rd, Burnley. Nom. cap.: £1,000. Dirs.: Walter Stopczynski and Mrs Nora Stopczynski.

Computer Controls Ltd., 19 Buckingham St, W.C.2. Manufacturers of and dealers in electrical and other instruments, etc. Nom. cap.: £1,000. Dirs.: Henry L. Schuster and Reginald G. Smith.

J. J. Coupland Ltd., 43 Hardman St, Liverpool 1. Electrical dealers, etc. Nom. cap.: £100. Dirs.: John J. Coupland and Mrs Florence M. Coupland.

Electronic Consultants Ltd. Nom. cap.: £100. General, mechanical and electrical engineering consultants, etc. Dirs.: to be appointed by subs. Subs.: J. J. F. Francis, The Directors' Hse, The British Museum, W.C.1; J. D. A. Leaver, 7/8 Norfolk St, W.C.2.

F.B.M. Electro-Mech Engineers Supply Co. Ltd. Nom. cap.: £100. Dirs.: Kenneth K. Ford, Sidney R. Matthews, George W. Hazell, Kenneth D. Barnett and George C. Crutchlow. Subs.: Jean Herbert and Thos. A. Herbert, 156 Strand, W.C.2.

Foley Electrical (Manchester) Ltd., 18 Charing Cross Rd, W.C.2. To carry on business of electrical engineers, etc. Nom. cap.: £5,000. Dirs.: to be appointed by subs. Subs.: Charles H. Collins and Cecil Finn.

Gray (Domestic Electrical Appliances) Ltd., Folly Bank Farm, Crawshawbooth, Rossendale, Lancs. Nom. cap.: £2,000. Dirs.: John Gray and Mrs Lily Gray.

Hydroforce Ltd., 6 Bishopsgate, E.C.2. Designers and manufacturers of and dealers in any equipment concerning hydraulic, electrical, atomic, mechanical or marine engineering, etc. Nom. cap.: £1,000. Permt. dirs.: Victor Silberstein, Ludomir Danilewicz and Leonard S. Danilewicz.

Jermyns of Jermyn Street Ltd., The Cedars, High St, Uxbridge. Manufacturers of and dealers in dynamos, etc. Nom. cap.: £100. Dirs.: Brian J. Jermyn, Mrs Naomi M. Jermyn and Marjorie B. Jermyn.

K.S.R. Ltd., 52 Mark La, E.C.3. To carry on business of buying, selling, letting on hire, manufacturers of and dealers in electrical, domestic, electronic, television and radio equipment, etc. Nom. cap.: £100. Dirs.: Anthony J. Sumption, Geoffrey M. Lyon, Paul L. Coutts-Trotter and Peter C. E. Dix.

Magnavox Electronics Ltd., Ripple Works, By-Pass Rd, Barking. Nom. cap.: £5,000. Dirs.: Frank M. Freimann, Henry Roughton and Gerald Ungaro.

Masters Machinery Ltd., Bader Works, Hersham Trading Estate, Hersham, Surrey. Manufacturers of and dealers in machinery for use in making electric bulbs and lamps, radio and television valves, etc. Nom. cap.: £5,000. Dirs.: Leonard J. Masters, Alfred F. Bader and Cecil A. Barber.

Maypole Electrical Ltd., 56 North St, Romford, Essex. Nom. cap.: £1,000. Dirs.: Stanley W. Sullivan, Mrs Violet V. Harris and Mrs Maria M. West.

Mectron Ltd., Henrietta Hse, Henrietta Pl, W.1. Electronic and automation engineers, etc. Nom. cap.: £100. Dirs.: Peter I. Paul-Huhne and Hugh E. Ascoli.

Metronic Ltd., 677 Finchley Rd, N.W.2. Nom. cap.: £300. Manufacturers of and dealers in electronic instruments, etc. Dirs.: to be appointed by subs. Subs.: John Ullman and Mrs Frances Ullman.

Midlands Electrical Products (Coventry) Ltd. Nom. cap.: £1,000. Dir.: Wm. Ward, 157 Ferrers Close, Tile Hill, Coventry. Sub.: Mrs Margaret P. Ward.

S.A.G.E.R. Ltd. Manufacturers of and dealers in electronic organs, record players, echo units, telephone systems, etc. Nom. cap.: £100. Dirs.: Edwd. H. Curtis, 18 Wellington Ave, Princes Risborough; and John R. Jeffries, 6 Loudhams Rd, Little Chalfont, Bucks.

Solartron-John Brown Automation Ltd. Nom. cap.: £100,000. Dirs.: to be appointed by subs. Subs.: Solartron Electronic Group Ltd., Thames Ditton, Surrey; and John Brown and Co. Ltd.

MEETINGS TO NOTE

THURSDAY, 19 MAY

I.E.E. A.G.M. and "Technical Features of a New Television Studio at Wembley," A. M. Spooner. Savoy Pl. 6.30 p.m.

S. Wales Institute of Engineers. "The Aberthaw Power Station," W. Wilde. Park Pl, Cardiff. 6 p.m.

FRIDAY, 20 MAY

I.E.E. (Western Centre). Summer meeting at Abrenant Hotel, Llanwrtyd Wells, until 23 May.

A.S.E.E. Annual Conference. Royal Hotel, Scarborough, until 22 May.

A.S.E.E. (Coventry Branch). A.G.M. E.M.E.B. Sports and Social Club, Merrick Lodge, Sandy La. 7.30 p.m.

SATURDAY, 21 MAY

I.E.E. (Supply Section). Visit to Cambridge.

I.E.E. (N.W. Graduate and Student Section). Social week-end at Lyme Hall, Disley, Ches.

I.E.E. (Southern Centre). Summer meeting. B.B.C. Television Studios.

MONDAY, 23 MAY

Royal Society of Arts. Cantor lecture: "The Retail Distribution of Electricity," C. R. King. John Adam St, W.C.2. 6 p.m.

Institute of Fuel. "Recommendations on Heights for New Industrial Chimneys," G. Nonhebel. Institution of Civil Engineers, Gt. George St, S.W.1. 5.30 p.m.

A.S.E.E. (N.W. London Branch). "Impact of the N.I.C.E.I.C.", E. J. Sutton. Compass Hotel, Watford. 8.15 p.m.

International Instruments, Electronics and Automation Exhibition at Olympia until 28 May.

TUESDAY, 24 MAY

Society of Instrument Technology. A.G.M. and presidential address, R. S. Medlock. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

Institution of Plant Engineers (S. Wales Branch). "Controlled Maintenance," G. E. Halter. S. Wales Engineers' Institute, Park Pl, Cardiff. 7.30 p.m.

A.S.E.E. (E. Kent Branch). "Earth Leakage Protection of Domestic and Similar Installations," J. A. Robbins. Clarendon Hotel, Broadstairs. 8 p.m.

A.S.E.E. (Newcastle-on-Tyne Branch). A.G.M. Crown Hotel, Clayton St, Newcastle. 7.30 p.m.

WEDNESDAY, 25 MAY

I.E.E. (Electronics and Communications Section). Discussion: "New Semiconductor Devices and Their Possible Applications." Savoy Pl. 5.30 p.m.

British Institution of Radio Engineers. Symposium on "Stable Frequency Generation." London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

E.D.A. National final of "Electricity Quiz Competition" at Royal Albert Hall. 7 p.m.

A.S.E.E. (Wolverhampton Branch). A.G.M. Chamber of Commerce, District Bank Chmbrs, Lichfield St. 7 p.m.

THURSDAY, 26 MAY

Institution of Plant Engineers (Mersey and N. Wales Branch). "Packaging and Container Engineering," E. Evans. Exchange Hotel, Liverpool. 7.15 p.m.

A.S.E.E. (Brighton, Hove and District Branch). "Variable Speed A.C. Motors." New Imperial Hotel, First Avenue, Hove. 7.30 p.m.

A.S.E.E. (Southampton Branch). "Electricity as Supplied to the Printing Trade," S. C. Bellringer. Polygon Hotel. 8 p.m.

A.S.E.E. (S. London Branch). A.G.M. Greyhound Hotel, High St, Croydon. 7.15 p.m.

FRIDAY, 27 MAY

A.S.E.E. (Aldershot Branch). A.G.M. Queen's Hotel, South Farnborough. 7.30 p.m.

A.S.E.E. (Liverpool Branch). A.G.M. Industrial Development Centre, M.A.N.W.E.B., Paradise St. 6.30 p.m.

MONDAY, 30 MAY

British Electrical Power Convention at Bournemouth until 4 June.

Electrical Trades' Union. Annual Policy Conference opens at Hastings.

CONTRACTS PLACED

British Railways. Supply and installation of cables and fittings at Gateshead Greenesfield motive power depot and lighting installation improvements at Bank Top Station, Darlington, S. H. Heywood and Co. Ltd.; supply of cable and switchgear for Tweedmouth colour light signalling, Enfield-Standard Power Cables Ltd.

Hereford B.C. Installation of 28 Group "B" columns, A.E.I. Ltd., £1,238. Recommended.

Heston and Isleworth B.C. Provision of street lighting, Shrewsbury Walk, South St, G.E.C., £638; columns and brackets for lighting improvement, Whitton Rd, A.E.I. Lamp and Lighting Ltd., £3,476. Recommended.

Luton. Electrical installations: in science block and swimming pool conversion, Luton High School, H. C. Janes, £6,516; in 20 old people's dwellings, Farley Hill/Whipperley Way, E. Twigg, £1,700; in Challney Secondary School extensions, J. H. Burtenshaw, £881.

Peterborough T.C. Electrical installations: in 54 flats, M. F. Hanson, £1,476; and 38 houses all on Gunthorpe estate, Peterborough Electrics, £758. Recommended.

Scunthorpe B.C. Wiring work in 243 houses, G. J. A. Rowley, £6,201. Recommended.

West Ham C.B. Supply and erection of steel columns complete with 250 W mercury lanterns and gear, Abacus Eng. Ltd.

West Hartlepool T.C. Supply of 250 time switches, A.E.I. Ltd.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

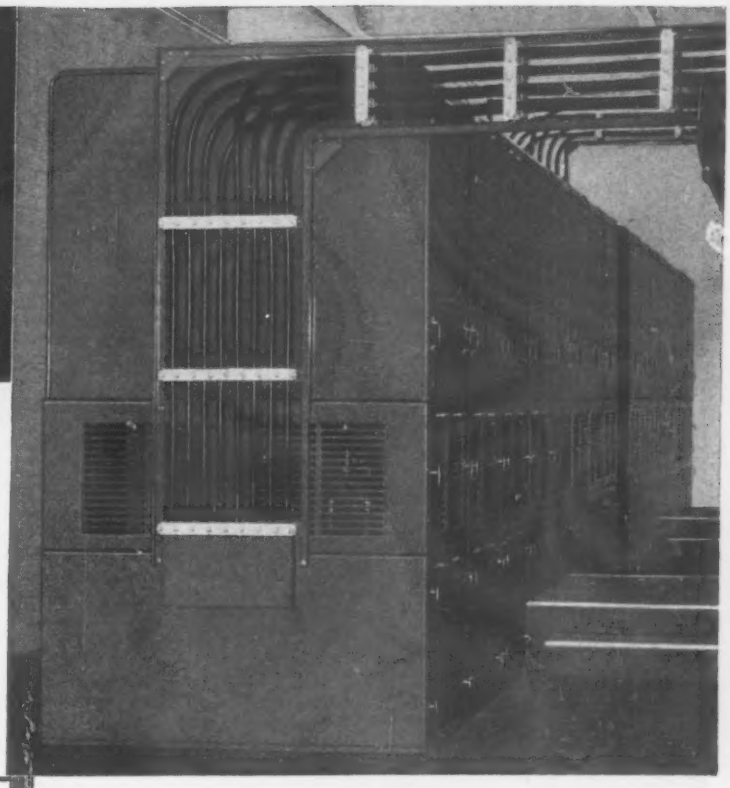
Canolectric. 798,436. Class 7. Can opening machines, etc. Pifco Ltd., Pifco Hse, Watling St, Manchester 4.

Circon. 801,542. Class 7. Lubricating systems being parts of motors, etc. Associated Electrical Industries Ltd., 33 Grosvenor Pl, S.W.1.

Ruton, in design. 797,850. Class 11. Domestic apparatus, refrigerators, etc. Electrische Apparaten-en-Metaalwarenfabrieken Rudolf Blik N.V. Televisiestraat Loek Rutonweg, The Hague, Netherlands.

Silcad. 800,357. Class 9. Batteries. Yardney Electric Corpn., 40/50 Leonard St, New York, N.Y., U.S.A.

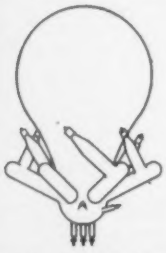
HEWITTIC Cooled-Cathode RECTIFIERS



Increased output -less space

The Hewittic cooled-cathode rectifier is essentially compact and provides a very high capacity within a given floor area.

Right: Two Hewittic cooled-cathode rectifiers forming a 5000 kW bank in the Dover Substation British Railways, Southern Region:



CONVENTIONAL

COOLED-CATHODE

- **Smaller size (see comparison between conventional and cooled-cathode bulbs of same capacity above).**
- **Improved efficiency at lower voltages.**
- **Dependability of bulb maintained.**
- **Ease of installation and maintenance.**

Send for publication R192/1

750 kW 3000 volt Hewittic cooled-cathode rectifier bulb

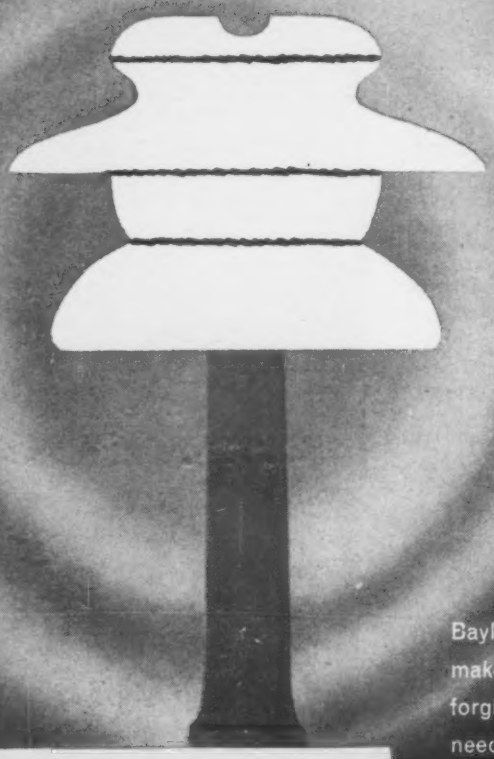
HACKBRIDGE AND HEWITTIC ELECTRIC CO. LTD.

WALTON-ON-THAMES - SURREY - ENGLAND

Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: "Electric, Walton-on-Thames"

OVERSEAS REPRESENTATIVES: ARGENTINA: H. R. Roberts & Cia., S.R.L. Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria; N.S.W.: Queensland: W. Australia: Elder, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BELGIUM & LUXEMBOURG:** Pierre Follie, Brussels, 3. **BRAZIL:** Oscar G. Mors, Sao Paulo. **BURMA:** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Esa Ltd., Colombo. **CHILE:** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA:** G. A. Neumann Ltd., Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sähkö-ja Konelilke O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE:** Glyndova Ltd. **GREECE:** Charilaos C. Coroneos, Athens. **INDIA:** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper, Gilfillan & Co. Ltd., Kuala Lumpur. **NETHERLANDS:** J. Kater, E.O., Ouderkerk a.d. Amste.. **NEW ZEALAND:** Richardson, McCabe & Co. Ltd., Wellington, etc. **PAKISTAN:** The Karachi Radio Co., Karachi, 3. **SOUTH AFRICA:** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION:** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Fort of Spain. **TURKEY:** Dr. H. Salim Oker, Ankara. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA:** Oficina de Ingenieria Sociedad Anonima, Caracas.

BJB CARRY POWER ACROSS THE WORLD



Bayliss, Jones and Bayliss make all the galvanised forgings and steelwork needed for safe, efficient transmission lines—whether it's a local distribution circuit or a high voltage network—and their equipment is used by Electricity Authorities all over the world. *Most standard items can be delivered from stock.*

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HEAD OFFICE: VICTORIA WORKS, WOLVERHAMPTON · TELEPHONE: WOLVERHAMPTON 20441

LONDON OFFICE: 139 CANNON STREET, E.C.4. · TELEPHONE: MANSION HOUSE 8524

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

STEPNEY M.B.C.
Smithy Street Housing Scheme

TENDERS are invited for:
Two passenger lifts in nine-storey block of 52 flats. Forms of tender, with conditions, etc., obtainable from Messrs Riches and Blythin, 16 Northumberland Ave, W.C.2, as from 16 May, 1960, on deposits of £2 2s. Cheque to be made payable to Stepney Borough Council.

Closing date for tenders: noon, Monday, 30 May, 1960.

WILFRED REEVE,
Town Clerk.
(P 895)

ELECTRICITY CORPORATION OF NIGERIA
Invitation to Tender

LOW VOLTAGE SWITCHBOARDS

THE Electricity Corporation of Nigeria invites Tenders for the supply of the following:—

1 No. Low Tension 15 MVA 6 Panel Switchboard and 1 No. 10 Panel Switchfuse Board.

Tender documents giving further details of the Contract may be obtained from the Resident Engineer, Electricity Corporation of Nigeria, John Adam St, Adelphi, London, W.C.2.

Each Tender must be enclosed in a sealed envelope marked "Confidential—Tender for supply of Low Voltage Switchboards" and must be received at the Office of the Secretary, Electricity Corporation of Nigeria, Electricity Headquarters, Private Mail Bag 2030, Lagos, Nigeria, West Africa, not later than noon on 22 June, 1960. Tenders received in any other manner will not be considered.

The Electricity Corporation of Nigeria does not undertake to accept the lowest or any tender.

Further information concerning this Contract may be obtained on application to the Resident Engineer.

GEORGE W. NICOL.
Acting Secretary to the Corporation.
(P 894)

CHESHAM URBAN DISTRICT COUNCIL
Street Lighting Stage 2

TENDERS are invited for the supply and erection of No. 49 Steel Group "A" lighting columns fitted with 250 watt colour corrected mercury vapour lanterns and No. 24 Steel Group "B" lighting columns fitted with 125 watt colour corrected mercury vapour lanterns with all lamps and control gear.

Specifications and Bills of Quantities may be obtained and conditions of contract and layout drawings inspected at the office of the Engineer and Surveyor of the Council.

Tenders in plain sealed envelopes bearing the words "Street Lighting Stage 2" must be received by me not later than Saturday, 11 June, 1960.

The Council do not bind themselves to accept the lowest or any tender.

W. I. NASH,
Clerk of the Council.

Council Offices,
Chesham, Bucks. (P 893)

APPOINTMENTS VACANT

THE NORTH EASTERN ELECTRICITY BOARD
Wear Sub-Area

APPLICATIONS are invited for the following appointments:

FIRST ASSISTANT DISTRICT ENGINEER
DURHAM DISTRICT

Salary: Schedule A, Class F, Grade 4, £1,095/£1,170 per annum. N.J.B. conditions of service.

SECOND ASSISTANT DISTRICT ENGINEER
CHESTER-LE-STREET DISTRICT

Salary: Schedule A, Class F, Grade 7, £910/£955 per annum. N.J.B. conditions of service.

It is anticipated that these Districts will be reclassified Class G.

Applicants should have had sound training and experience in construction, operation and maintenance of H.V. and L.V. Overhead and Underground Distribution Networks, substation plant and auxiliary equipment. Preference will be given to candidates with qualifications leading to corporate membership of I.E.E.

If application has already been made to previous advertisement, it is not necessary to reapply.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box 117, Carliol Hse, Newcastle upon Tyne, within 10 days of the appearance of this advertisement. (P 874)

PATENT EXAMINERS AND PATENT OFFICERS

PENSIONABLE posts for men or women for work on the examination of Patent applications. Age at least 21 and under 29 (36 for Examiners), with extension for regular Forces service and Overseas Civil Service. Qualifications: normally first- or second-class honours degree in physics, chemistry, engineering or mathematics, or equivalent attainment, or professional qualification, e.g., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.R.I.C. London salary (men) £655/£1,460; provision for starting pay above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley St, London W.1, for application form, quoting S/128/60, and stating date of birth. (P 859)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONSUMERS' ENGINEERS (TWO)

REQUIRED in the Warrington District of the Board's No. 2 Sub-Area. Salary within range £610/£655 per annum (N.J.B. G/14).

Duties will include estimating for contracting work and advising consumers on matters relating to electricity supply and the utilisation of electrical equipment. A technical qualification is desirable.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 30 May, 1960. (P 891)

FEDERATION OF RHODESIA AND NYASALAND
Federal Power Board

APPOINTMENT OF ASSISTANT CIVIL ENGINEER

THE Federal Power Board invites applications for the post of Assistant Civil Engineer at its Head Office in Salisbury.

The person appointed will be required to carry out administrative engineering duties in connection with the development of electricity supplies in the Federation, and particularly in connection with hydro-electric projects. He may also be required to work in the field periodically.

Candidates should preferably be Chartered Civil Engineers or should be in a position to sit their final professional examinations. A knowledge of water engineering generally and experience in the supervision of heavy civil engineering contracts would be of advantage.

The appointment will be to the Board's permanent staff, after a probationary period, and the successful candidate will be required to become a contributor to the Board's pension fund.

Salary: About £1,750 per annum.

Applications, giving full details of age, experience and qualifications, should be posted so as to reach the Secretary, Federal Power Board, Reliance Hse, P.O. Box 630, Salisbury, not later than 4 June, 1960. (P 854)

BOROUGH OF POOLE

ELECTRICAL ENGINEERING ASSISTANT GRADE III (£880/£1,065)

APPLICATIONS for the above post are invited from properly trained Electrical Engineers of not less than Higher National Certificate standard.

Applicants must have had design and estimating experience as consumers' or contracts engineers, and be capable of supervising works on contract sites. The work will be related to the internal and external engineering and architectural branches, and some knowledge of street lighting would be an asset.

Application forms and details of the appointment are available from the Borough Engineer, Municipal Bldgs, Poole, Dorset, and must be returned to the undersigned not later than Saturday, 27 May, 1960.

J. G. HILLIER,
Town Clerk.
(P 858)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

Vacancy No. 116/60.

SENIOR ASSISTANT ENGINEER

REQUIRED to take charge of the District of the Divisional Electrical Engineer's department based at Northfleet Power Station. The successful candidate will be responsible for the administration of all Construction, Operation and Maintenance work within the District.

Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualification. They must have had extensive experience in the construction and maintenance of 132 kV (and preferably 275 kV) transmission equipment.

Experience of Joint Consultation and Negotiating Machinery would be advantageous and evidence must be produced of administrative ability.

Salary: Class AX/DX, Grade 3, £1,415/£1,655 per annum including London Allowance.

Applications, giving details of education, qualifications, present position, experience, etc., should be sent to the Personnel Officer, Central Electricity Hse, Lower Ham Rd, Kingston upon Thames, Surrey, to arrive by 31 May, 1960.

W. H. DUNKLEY,
Divisional Controller.
(P 879)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

SOUTHERN RHODESIA GOVERNMENT

VACANCY: ELECTRICAL ENGINEER

A VACANCY exists in the Southern Rhodesia Department of Engineering and Construction for an Electrical Engineer to take charge of the installation of rural and urban electrical distribution up to 11 kV, including the preliminary detailed design and layout. He will be based in Salisbury but will be required to work in any part of the Colony. The salary offered is £1,785 x £78 15s—£1,942 10s per annum, and the minimum qualification is Graduate of the Institution of Electrical Engineers.

The appointment may lead, within four or five years' time, to Senior Electrical and Mechanical Engineer of the Department. For this the minimum qualification will be Associate of the Institution of Electrical Engineers.

Application forms and further details from the Secretary (R), Rhodesia Hse, 429 Strand, London, W.C.2. Closing date: 15 June, 1960. (P 882)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Birmingham & District Sub-Area

DISTRICT COMMERCIAL ENGINEER
(SOUTH EAST DISTRICT)

Duties will include advice on utilisation, negotiations with consumers for supplies of electricity, preparation of estimates, etc., supervision of contracting work, Service Centres and consumer service. Applicants should have had a sound technical training and wide practical experience of industrial, commercial, and domestic installations and their electrical requirements. Technical qualifications desirable. Salary: £1,470/£1,575 per annum (N.J.B. Grade 3, Class J).

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER
(NORTH WEST DISTRICT)

Duties will include advice on utilisation, negotiations with consumers for supplies of electricity, preparation of estimates, etc., supervision of contracting work and consumer service. Applicants should have had a sound technical training and wide practical experience of industrial, commercial and domestic installations and their electrical requirements. Technical qualifications an advantage. Salary: £1,195/£1,270 per annum (N.J.B. Grade J.6).

Apply, by letter, within seven days, stating age, experience, qualifications, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

Worcester & District Sub-Area

THIRD ASSISTANT ENGINEER
(SUBSTATION CONSTRUCTION SECTION)
(HEADQUARTERS)

The successful applicant will be required to assist in the construction of Primary Substations operating at 66 and 33 kV. Previous experience and technical qualifications desirable. Salary: £965/£1,025 per annum (N.J.B. Grade K.10). Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, P.O. Box No. 52, Blackpole Rd, Worcester.

SENIOR DRAUGHTSMAN
(REDDITCH/BROMSGROVE DISTRICT)

The successful applicant will be required to take charge of the Drawing Office. Applicants should have had a sound technical education and experience in the preparation of engineering drawings, substation design, and layout plans, keeping of permanent mains records, and general Drawing Office routine. Salary: £790/£890 per annum (N.J.B. Grade 5, Schedule D). Apply, by letter, within 14 days, stating age, experience, present position and salary to District Manager, Midlands Electricity Board, Windsor Rd, Redditch.

F. W. CATER,
Secretary.
(P 876)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPOINTMENT OF SECOND ASSISTANT DISTRICT ENGINEER
(HAMILTON DISTRICT)

APPLICATIONS are invited for the above appointment. Applicants should have had a sound engineering and technical training. They should have had subsequent experience with the maintenance and operation of HV and LV overhead and underground networks and substations on a large distribution system. They should also be conversant with load flow diagrams, voltage drop and short-circuit calculations and should have had experience with HV fault location.

The Salary and Conditions of Service for this appointment will be in accordance with the National Joint Board Agreement, Schedule A, the present Classification and Grading being F7, salary £910/955 per annum. The post will be superannuable.

Application forms, which may be obtained from the undersigned, should be returned to this office within fourteen days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Cres,
Hamilton. (P 869)

ELECTRICITY DEPT.

Cape Town, South Africa

POWER STATION CHEMIST

A VACANCY exists in the Generation Branch of the Electricity Department of the City Council of Cape Town, South Africa, for a suitably qualified person for the position of Power Station Chemist.

The scale of pay (total emoluments) applicable to the post is £1,560 with two increments of £60 to a maximum of £1,680 per annum.

Applicants must possess a degree in Chemistry of a recognised university or an equivalent qualification. They must have had experience in a power station laboratory and be familiar with the methods of sampling and analysis of materials used in a power station, preferably with advanced steam conditions. A knowledge of nuclear physics and the use of radio-active isotopes will be an advantage.

Persons possessing the requisite qualifications and experience are invited to apply not later than Monday, 23 May, 1960, and to address their applications to:

Messrs Merz and McLellan,
Carliol Hse,
Newcastle upon Tyne,
England,

from whom further particulars relating to the vacant position may be obtained. (P 752)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

DRAUGHTSMEN
(MECHANICAL AND ELECTRICAL)

APPLICATIONS are invited for the appointments of Draughtsman (Mechanical and Electrical) in the Midlands Project Group at Bournville.

Applicants should have a sound technical and practical training in mechanical or electrical engineering together with drawing office experience of the layout of Power Station or other Heavy Industrial Plant.

The possession of an appropriate H.N.C. or O.N.C. would be an advantage.

The salary for the post will be in accordance with Grade 5 (£790/£890 per annum) and Grade 6 (£620/£740 per annum).

Applications should be made on form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham, and should be returned to him not later than 30 May, 1960.

Envelopes should be marked "Confidential, Vacancy No. MPG.38/60. (P 881)

CITY OF SALISBURY : SOUTHERN RHODESIA

Vacancy for Electrical Engineer (Protection)

SALARY SCALE: £1,025 x £102 10s—£1,332 10s x £76 17s 6d—£1,563 2s 6d x £51 5s—£1,768 2s 6d PER ANNUM.

APPLICATIONS are invited for the fixed establishment post of Electrical Engineer (Protection) in the Salisbury Municipal Electricity Department on the scale £1,025 x £102 10s—£1,332 10s x £76 17s 6d —£1,563 2s 6d x £51 5s—£1,768 2s 6d per annum. No allowances are payable.

Commencing salary is based on qualifications and experience. There is a barrier at £1,563 2s 6d per annum, above which no engineer can rise without being a corporate member of the British Institution of Electrical Engineers, and the maximum entry point into the grade is £1,614 7s 6d per annum.

Candidates must be graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree, and have had not less than five years' experience in general protection work.

Consideration, however, will be given to applicants who have not the above qualifications, but who have had extensive practical experience. The salary scale applicable in such instance will be £1,568 5s x £51 5s —£1 722 per annum, commencing salary being at the minimum of the grade.

The successful applicant will work under the direction of the Test Engineer in the Consumers' Engineers' Section and his duties will comprise mainly:

1. Design and commissioning of all types of protection schemes on generators, feeders, motors, transformers and other types of electrical equipment.

2. Determination of relay settings and the calculation of fault currents over the system.

3. Supervision of staff engaged in the maintenance and repair of all relays and instruments associated with protection schemes.

The Department has an extensive supervisory indication, control and telemetering scheme and experience with similar equipment is desirable. Experience with electronic equipment would be considered an advantage.

The appointment will be subject to the City Council's Service and Leave Regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months and, if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Davis and Soper Ltd., 52-54 St. Mary Axe, London E.C.3, to whom applications must be submitted on or before 4 June, 1960. (P 838)

ELECTRICAL ENGINEER

required at Southern Outfall Works, Belvedere, Kent, to assist in supervising the erection and commissioning of HV and MV plant, including switchgear and comprehensive lighting, heating and power installation. Salary up to £1,040 (under review) according to qualifications and experience. Pension scheme. Form from Chief Engineer (GS/ET/1229/5), L.C.C., County Hall, S.E.1. (P 867)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

THIRD ASSISTANT DISTRICT ENGINEERS
EDINBURGH DISTRICT

SALARY: N.J.B. SCHEDULE A, CLASS G, GRADE 9, £860/£905 p.a.

APPLICATIONS are invited to fill engineering vacancies in the three Edinburgh Districts.

Applicants should have a sound training and subsequent experience with HV and LV underground distribution systems, including the operation and maintenance of HV and LV switchgear and a knowledge of protective gear and fault location. They should also possess a National Certificate of Electrical Engineering or an equivalent qualification.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The successful candidates, subject to satisfactory evidence of health, will require to become contributors to the Board's Superannuation Scheme.

In each case the successful candidate will require to reside within a reasonable distance of the District office.

Applications, on the standard form obtainable from the undersigned or any other Area Manager, should be submitted not later than 3 June, 1960.

C. H. C. COLLYNS,
Manager.
(P 871)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

APPLICATIONS are invited for the following appointments in the Midlands Project Group at Rugeley Power Station Site.

(a) SECOND ASSISTANT ENGINEER (MECHANICAL)

N.J.B. Grade 4, £1,195/£1,545 per annum, Schedule C.

Vacancy No. MPG.30/60.

Applicants should have had experience in the manufacture and erection of boilers, turbo-alternators and other mechanical equipment associated with a modern power station.

Appropriate technical qualifications will be an advantage.

(b) SECOND ASSISTANT ENGINEER (ELECTRICAL)

N.J.B. Grade 4, £1,195/£1,545 per annum, Schedule C.

Vacancy No. MPG.31/60.

Applicants should have had experience in the manufacture, erection, maintenance and operation of electrical plant as installed in modern power stations.

Appropriate technical qualifications will be an advantage.

(c) THIRD ASSISTANT ENGINEER (MECHANICAL)

N.J.B. Grade 5, £1,090/£1,300 per annum, Schedule C.

Vacancy No. MPG.32/60.

Applicants should have a fundamental training in Mechanical Engineering and should have had experience in the manufacture and erection of mechanical equipment associated with a modern power station.

Appropriate technical qualifications will be an advantage.

(d) THIRD ASSISTANT ENGINEER (ELECTRICAL)

N.J.B. Grade 5, £1,090/£1,300 per annum, Schedule C.

Vacancy No. MPG.33/60.

Applicants should have a fundamental training in Electrical Engineering and should have had experience in the manufacture, erection, maintenance and operation of electrical plant as installed in modern power stations.

Appropriate technical qualifications will be an advantage.

(e) SECOND ASSISTANT ENGINEER (PROGRESS)

N.J.B. Grade 4, £1,195/£1,545 per annum, Schedule C.

Vacancy No. MPG.34/60.

Applicants should preferably possess a Higher National Certificate in either

continued in next column

continued from previous column

Mechanical or Electrical Engineering and have served a recognised engineering apprenticeship. Experience in the construction of heavy plant as installed in modern power stations, either in a manufacturers' works or on site, is essential and a knowledge of the civil engineering work involved would be an advantage.

The selected candidate will be required to maintain up-to-date charts on the progress of the works on site in accordance with previously agreed programmes, and to assist the Resident Engineer in anticipating any divergence from these programmes. Ability to co-ordinate with Regional P.I.T. Officers will be required.

Applications for the above-mentioned posts should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, 341 Bournville La, Birmingham, to be returned to him not later than 27 May, 1960. (P 856)

WESTERN REGIONAL HOSPITAL BOARD

SCOTLAND

Engineers

APPLICATIONS are invited for the following posts:

(a) ENGINEERS—GENERAL GRADE

Salary scale: £910/£1,600 per annum. Applicants should either be Corporate Members of the Institutions of Mechanical or Electrical Engineers (who will enter the scale at £1,160), or Corporate Members of the Institution of Heating and Ventilating Engineers (for whom there is a bar at £1,400 per annum). Graduate Members of above Institutions may be considered suitable, but the maximum salary in this case will be limited to £1,205 per annum. Applicants should have practical and theoretical experience of design, installation, operation and maintenance, and should be capable of preparing specifications, estimates and drawings and advising generally on engineering services in buildings.

(b) ENGINEERING DRAUGHTSMEN

Salary scales:
Grade I—£1,030/£1,250.
Grade II—£870/£1,010.
Grade III—£550/£850.

(c) CLERK OF WORKS (ENGINEERING)

Salary scale: £800/£1,050.

(d) TRACER (FEMALE)

£230/£565 per annum.

Applications, stating age, training, qualifications, experience and present appointment, should be sent, together with names and addresses of three referees, to the Secretary, Western Regional Hospital Board, 351 Sauchiehall St, Glasgow C.2. (P 883)

THE SOUTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT

APPLICATIONS are invited for the position of Commercial Assistant in the Llanelly District of the Swansea and West Central Area of the Board.

Preference will be given to candidates possessing a Higher National Certificate of Electrical Engineering or an equivalent qualification.

The salary for the position will be in accordance with Class F, Grade 7 (£910/£955) of the National Joint Board Agreement for the Electricity Supply Industry. At the present rate of progress, there are prospects that the classification of this District will be Class G in the not too distant future.

Applications stating age, present position, present salary, qualifications and experience should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, Glam, so as to reach him not later than Tuesday, 31 May, 1960.

Envelopes should be endorsed "Commercial Assistant—93/60."

R. G. WILLIAMS,
Secretary.
(P 857)

FEDERATION OF RHODESIA AND NYASALAND

Federal Power Board

APPOINTMENT OF SENIOR ASSISTANT CIVIL ENGINEER

THE Federal Power Board invites applications for the post of Senior Assistant Civil Engineer at its Head Office in Salisbury.

The person appointed will be required to carry out administrative engineering duties in connection with the development of electricity supplies in the Federation, and particularly in connection with hydro-electric projects.

Candidates must be Chartered Civil Engineers and should have knowledge and experience of the development and administration of major civil engineering projects, preferably in the hydro-electric field.

The appointment will be to the Board's permanent staff, after a probationary period, and the successful candidate will be required to become a contributor to the Board's pension fund.

Salary: About £2,200 per annum.

Applications, giving full details of age, experience and qualifications, should be posted so as to reach the Secretary, Federal Power Board, Reliance Hse, P.O. Box 630, Salisbury, not later than 4 June, 1960. (P 853)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

THIRD ASSISTANT ENGINEER (MECHANICAL)

APPLICATIONS are invited for the position of Third Assistant Engineer (Mechanical) at Uskmouth "B" Power Station Site.

Applicants should have had a fundamental training in mechanical engineering, including workshops, and should preferably have experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Appropriate technical qualifications will be an advantage.

The salary will be in accordance with Schedule C, Grade 5 (£1,090/£1,300 per annum).

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box No. 314, 341 Bournville La, Birmingham, and should be returned to him not later than 1 June, 1960.

Envelopes should be marked "Confidential" Staff Vacancy Notice No. MPG.35/60. (P 855)

AIR MINISTRY

REQUIRE ASSISTANT MECHANICAL and ELECTRICAL ENGINEERS for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports. Salary: £805 at 25 to £1,095 at 34 or over, thereafter rising to max. £1,260 with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. Five-day week with four weeks two days leave a year initially. Special allowance in addition to salary during overseas service. Quals. and experience:

(i) (a) University degree or equiv. diploma in electrical and/or mechanical engineering with at least two years' apprenticeship;

or (b) Graduate or corporate member of I.E.E. with at least three years' apprenticeship;

or (c) Graduate or corporate member of I.Mech.E. appreciable electrical engineering experience with at least three years' apprenticeship;

and (ii) Have been employed for minimum of two years with well established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural born British subjects between ages of 25 and 45. Forms from Ministry of Labour, Technical and Scientific Register (K), 26 King St, London S.W.1, quoting D.158/OA. (P 875)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

ASSISTANT CONTRACTING ENGINEER

REQUIRED in the Liverpool Central District of the Board's No. 1 Sub-Area.

Salary within range £860/£905 per annum (N.J.B. J/11).

Candidates should have had experience of electrical contracting, including estimating and supervision of work on site.

Appointment subject to medical examination. Pension scheme.

Special application forms, available from the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, should be completed and returned not later than 30 May, 1960. (P 889)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 131/ET/60.

APPLICATIONS are invited for the superannuable N.J.B. appointments of SHIFT CHARGE ENGINEER at Uskmouth "B" Power Station, West Nash, near Newport, Mon.

Salary: K.6, £1,270/£1,360 per annum.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 3 June, 1960. (P 877)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (CONSTRUCTION)

REQUIRED at No. 2 Sub-Area Headquarters, Sandiway Hse, Northwich, Cheshire.

Salary within range £1,195/£1,270 per annum (N.J.B. K/7).

Applicants should have considerable experience in the construction of H.V. and M.V. distribution networks, including substations and associated equipment at supply points, underground cables and overhead lines. Technical qualifications desirable.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date: 30 May, 1960. (P 892)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

NORTHWOOD DISTRICT

FOURTH ASSISTANT ENGINEER

115/60.R.

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground systems, including substations.

Salary: N.J.B. Class F, Grade 11 (£710/£755) plus London Weighting.

Apply by letter to the Manager, Northwood District, Eastern Electricity Board, 1 Love La, Pinner, by 3 June, 1960.

Essex Sub-Area

SUB-AREA HEADQUARTERS

THIRD ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

116/60.N.

Candidates should have had a sound technical training and suitable experience in the design and layout of indoor and outdoor substations and of overhead and underground systems up to 33 kV. They should preferably be Graduate Members of the Institution of Electrical Engineers.

Salary: N.J.B. Class L, Grade 10 (£1,025/£1,085) plus London Allowance.

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FOURTH ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

117/60.R.

Candidates should have had a sound technical training, possess the Higher National Certificate, and have had suitable experience in the design and layout of indoor and outdoor substations and overhead and underground systems.

Salary: N.J.B. Class L, Grade 13 (£860/£905) plus London Allowance.

For these appointments apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, near Brentwood, Essex, by 3 June, 1960.

THURROCK DISTRICT

THIRD ASSISTANT ENGINEER

118/60.N.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems, including substations.

Salary: N.J.B. Class G, Grade 9 (£860/£905) plus £50 London Allowance.

Applications by letter, stating age, education, qualifications and experience should be addressed to H. J. Unwin, A.M.I.E.E., Manager, Thurrock District, Eastern Electricity Board, Maidstone Rd, Grays, Essex, by 3 June, 1960.

Applications submitted for vacancy number 61/60.N will be reconsidered and the applicants need not re-apply.

Norfolk Sub-Area

KING'S LYNN AND WESTERN DISTRICT

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER

120/60.N.

Applicants should have wide knowledge of all commercial aspects and, in particular, experience in industrial and other large power supplies and their appropriate negotiations. The successful applicant will be required to deal with special tariff negotiations and will be responsible to the District Commercial Engineer for general assistance in the administration of the District Commercial Organisation, with special responsibility for technical work. Experience in control of staff would therefore be an added advantage.

Salary: N.J.B. Class F, Grade 6 (£965/£1,025).

Apply by letter to the Manager, King's Lynn and Western District, Eastern Electricity Board, Gaywood Bridge, Wootton Rd, King's Lynn, by 3 June, 1960.

SECOND ASSISTANT ENGINEER

119/60.R.

Applicants should have had a sound technical training and considerable experience in the construction, operation and maintenance of overhead and underground distribution systems (including substations) at voltages up to and including 33 kV.

Salary: N.J.B. Class F, Grade 7 (£910/£955).

Apply by letter to the Manager, King's Lynn and Western District, Eastern Electricity Board, Gaywood Bridge, Wootton Rd, King's Lynn, by 3 June, 1960.

Suffolk Sub-Area

BURY ST. EDMUNDS DISTRICT

THIRD ASSISTANT ENGINEER

121/60.R.

Candidates should have had a sound technical training and suitable engineering experience to assist in the planning, operation and maintenance (including preventive maintenance) of H.V. and L.V. overhead and underground systems at voltages up to and including 33 kV.

Salary: N.J.B. Class F, Grade 9 (£815/£860).

The successful candidate will be required to reside within reasonable proximity of Bury St. Edmunds.

Apply by letter to H. B. Rendle, A.M.I.E.E., Manager, Bury St. Edmunds District, Eastern Electricity Board, 4 Cornhill, Bury St. Edmunds, Suffolk, by 3 June, 1960.

Applications submitted for vacancy 60/60.R will be reconsidered and these applicants need not re-apply. (P 887)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

GENERAL ASSISTANT ENGINEERS

REQUIRED at Ironbridge Power Station for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, J14, £710/£755 per annum.

Applicants should have received a sound technical training and preferably have had some industrial engineering experience, and have as a minimum qualification the Ordinary National Certificate.

Apply, quoting Vacancy No. 105/60MD, on forms AE6, which are available from the Station Superintendent, Ironbridge Power Station, Buildwas, Salop, to whom they should be returned when completed not later than 27 May, 1960. (P 870)

LONDON ELECTRICITY BOARD

DEMONSTRATOR

APPLICATIONS are invited for the above position in the Board's North Western District. Initially the successful candidate will be based at Willesden La, N.W.2, but may be required to work at any showroom within the District.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate, including Electrical Housecraft, and have experience in conducting demonstrations at showrooms and general showroom duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the showroom and on consumers' premises.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £525/£625 per annum, plus the appropriate London Area Allowance.

Application form obtainable from Personnel Officer, 46 New Broad St, London E.C.2. Please quote ref.: PER/V/2871/T. (P 872)

YORKSHIRE ELECTRICITY BOARD

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT

DISTRICT ENGINEER

CANDIDATES should be Corporate Members of the Institution of Electrical Engineers and should have a wide experience in the Electricity Supply Industry. The successful applicant will be responsible for all engineering work on the Board's distribution systems within the District.

Salary: N.J.B., Class H, Grade 1, £1,600 x £35—£1,705 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 3 June, 1960.

No. 2 (Huddersfield) Sub-Area

SECOND ASSISTANT COMMERCIAL ENGINEER (COMMERCIAL, AGRICULTURAL AND INDUSTRIAL DEVELOPMENT)

Applicants should be engineers preferably with Corporate Membership of the Institution of Electrical Engineers. The duties comprise responsibility to the Sub-Area Commercial Officer for a sub-section which is to be formed to deal with the development of load in commercial, industrial and agricultural premises, and the appointment calls for considerable initiative to interpret and pursue an energetic sales policy within these limits. Specifically, experience in space heating, process heating, commercial catering, commercial and industrial water heating and utilisation of electricity for agricultural and horticultural purposes is required.

Salary: N.J.B., Class L, Grade 7, £1,270 x £30—£1,360 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 3 June, 1960. (P 884)

CENTRAL ELECTRICITY GENERATING BOARD
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

THIRD ASSISTANT ENGINEER
(SYSTEM PLANNING)
TECHNICAL DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 109/60.

Applicants should preferably hold an Electrical Engineering Degree or have attained the Higher National Certificate standard in Electrical Engineering. Preference will be given to candidates who have experience of fault calculations and of switchgear and protective gear systems.

Duties will include power system calculations, relay settings, preparation of system diagrams and operation of D.C. and A.C. calculators.

The salary will be in accordance with Class AX/EX, Grade 6 (£925/£1,170 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 27 May, 1960.

ASSISTANT ENGINEER (INSTRUMENTS)
HIGH MARNHAM POWER STATION
Vacancy No. 111/60.

Applicants should possess a sound technical training and have practical experience of modern power station instrumentation and automatic control. Experience of electronic equipment will be a distinct advantage.

The salary will be in accordance with Class M, Grade 10 (£1,095/£1,170 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 27 May, 1960.

GENERAL ASSISTANT ENGINEERS
HIGH MARNHAM POWER STATION
Vacancy No. 112/60.

Applicants should hold the Ordinary National Certificate in Mechanical or Electrical Engineering. There are good opportunities for keen Engineers who are willing to study new plant and methods.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £560/£700 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 27 May, 1960.

PLANT CONTROL ENGINEER
DRAKELOW "A" POWER STATION
Vacancy No. 117/60.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience. Technical qualifications to Higher National Standard desirable.

Salary will be in accordance with Class J, Grade 10 (£910/£955 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 27 May, 1960.

ASSISTANT SHIFT CHARGE ENGINEER
COVENTRY POWER STATION
Vacancy No. 118/60.

Applicants are required to take charge of shift operation of Boiler House plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of fuels and Chain Grate Stokers.

Salary will be in accordance with Class G, Grade 9 (£860/£905 per annum) of the National Joint Board Agreement, plus shift enhancement.

Closing date for receipt of applications, 3 June, 1960.

MAINTENANCE SUPERINTENDENT
CASTLE DONINGTON POWER STATION
Vacancy No. 114/60.

Applicants must have had considerable experience of both Mechanical and Electrical Maintenance in a large power station of

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advanced design. Technical qualifications to Higher National Certificate standard, or equivalent. Corporate Membership of one of the senior Engineering Institutions an advantage.

Experience in Budgetary Control, Maintenance Planning, Costing and Plant Records desirable.

The salary will be within Class L, Grade 4 (£1,600/£1,705 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 3 June, 1960.

ASSISTANT MAINTENANCE ENGINEER
(MECHANICAL)
CASTLE DONINGTON POWER STATION
Vacancy No. 115/60.

Applicants must have had considerable experience in the Mechanical Maintenance of large modern power stations. Technical qualifications to Higher National Certificate standard in Mechanical Engineering, or equivalent. Experience in Costing, Planning and Plant Records desirable.

The salary will be in accordance with Class L, Grade 6 (£1,360/£1,450 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications, 3 June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25 Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.

12 May, 1960. (P 886)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

SENIOR ASSISTANT ENGINEER
(TECHNICAL)

REQUIRED at No. 2 Sub-Area Headquarters, Sandiway House, Northwich, Cheshire. Salary within range £1,470/£1,575 per annum (N.J.B. K/4).

Applicants should have experience in modern protective systems and metering practice, including the testing and commissioning of high voltage switchgear, transformers and associated equipment. Technical qualifications desirable.

Duties will include responsibility for the supervision of meter testing and certification.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager at the above address. Closing date: 30 May, 1960.

(P 890)

THE EAST MIDLANDS ELECTRICITY BOARD
Derby and Burton Sub-Area

SENIOR DRAUGHTSMAN
Vacancy No. 54/60.

APPLICATIONS are invited from suitably qualified and experienced persons for the above position.

Salary: N.J.B., Schedule D, Grade 5, £790 x £20—£890 per annum.

The successful applicant will be required to take charge of the Drawing Office and should have experience in the preparation of engineering drawings, sub-station design, layout plans, keeping of permanent mains records and general Drawing Office routine.

Applications in writing giving details of age, experience and present position, and quoting the above vacancy number, should be forwarded to the Manager, Derby and Burton Sub-Area, Electricity Offices, Iron Gate, Derby, in a confidential envelope endorsed "Senior Draughtsman," within 14 days of the date of this advertisement.

(P 885)

NORTHAMPTONSHIRE EDUCATION COMMITTEE
Corby Technical College

REQUIRED for September, 1960, an ASSISTANT, Grade B, to teach Electrical Installation and National Certificate Electrical Engineering. A knowledge of Radio or Electronics will be an advantage. Salary in accordance with the Burnham Technical Report, £700/£1,150 per annum plus, as appropriate, graduate addition (£90 per annum), Good Honours Degree addition (£75 per annum), training addition; incremental allowance within scale for approved industrial experience.

Whilst no promise can be given, Corby Development Corporation have always given preference to teachers regarding housing.

Apply immediately (no forms), and in any case by 27 May, 1960, stating names, status and addresses of two referees, to the undersigned.

G. E. CHURCHILL,
Chief Education Officer.

County Education Offices,
Northampton. (P 880)

South Western ELECTRICITY

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following positions:

SECOND ASSISTANT DISTRICT ENGINEER
(CONSTRUCTION) WESTON

Salary within Class G, Grade 7, £965 x £20—£1,025, per annum of the N.J.B. Agreement.

The duties of the successful candidate include the supervision of construction work covering overhead and underground lines and substations for voltages up to and including 33 kV; preparation of working schedules, material indents and progress reports; the control and efficient employment of men and the development of mechanisation.

Corporate membership of the Institution of Electrical Engineers or equivalent qualifications will be an advantage and the possession of a current motor driving licence will be desirable.

Applications to be made on Standard Form AE6/ACT, obtainable by postcard only, from the District Manager, South Western Electricity Board, 168 Locking Rd, Weston-super-Mare. Closing date for receipt of completed applications is 4 June, 1960.

GENERAL ASSISTANT ENGINEER
(COMMERCIAL DEVELOPMENT)
BRISTOL CENTRAL (COMMERCIAL)
DISTRICT

Salary within Class K, Grade 14, £765 x £15—£810 per annum, of the N.J.B. Agreement.

The duties associated with this position will be connected with the development of the large commercial and industrial potential of the District. Satisfactory performance of these duties will necessitate the successful candidate possessing or acquiring a sound knowledge of electrical installations and I.E.E. and Factory Regulations; he will be required to estimate for electrical installations in factories, offices and shops, and to advise consumers on installation work, including tariffs and costs.

An engineering background is essential, and whilst commercial experience would be an advantage, consideration will be given to those engineering applicants with an aptitude for commercial work but without actual commercial experience.

Possession of appropriate technical qualifications at least equivalent to the O.N.C. in Electrical Engineering is desirable.

Applications to be made on Standard Form AE6/ACT, obtainable by postcard only, from the Manager, Bristol Central (Commercial) District, South Western Electricity Board, Electricity Hse, Colston Ave, Bristol 1. Closing date for receipt of completed applications is 4 June, 1960. (P 904)

LONDON ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEER

APPLICATIONS are invited for the above position. Initially the successful candidate will be located at 84 Romford Rd, Stratford, E.15.

Applicants should have a sound technical education to the standard of the Higher National Certificate, and have completed a recognised period of training in the Electricity Industry, or have equivalent experience.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £610 per annum rising to £745 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, London E.C.2. Please quote ref.: PER/V/2933/T. (P 873)

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

APPLICATIONS are invited for appointment as LECTURER in the Department of Electrical Engineering, with special reference to the transmission and distribution of electric power. Candidates should have a good honours degree in electrical engineering or the equivalent, and ability to participate effectively in research work in this field. A salary of not less than £1,350 per annum in the Lecturer scale (£1,050 x £50—£1,400; x £75—£1,850 per annum) would be offered to a suitable candidate, with £60 per annum London Allowance, F.S.S.U. benefits and Family Allowance. Three copies of application, giving details of qualifications and experience and the names of two referees, should reach Professor A. Tustin, Department of Electrical Engineering, Imperial College of Science and Technology, London S.W.7, by 13 June, 1960. (P 878)

LONDON ELECTRICITY BOARD

ASSISTANT DISTRIBUTION ENGINEER

APPLICATIONS are invited for the above position in the Board's Regency District at Aybrook St, London W.1.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience of all branches of engineering work associated with the organisation of a District Distribution Department.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 9—£1,015 per annum, rising to £1,075 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer, 46 New Broad St, London E.C.2. Please quote Ref. PER/V/2925/T. (P 905)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR SALES REPRESENTATIVE

DORKING AND EPSOM DISTRICT

SALARY: £640 x £20—£700 per annum under N.J.C. Grade 2. Superannuable. The person appointed will be required to give advice on supply matters, tariffs and appliance sales and installations for domestic and small commercial consumers. Applicants must be thoroughly conversant with all types of domestic electrical appliances and in addition to acting as an outside representative, must be prepared to carry out general showroom duties in any showroom within the Dorking and Epsom district. Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 56 South St, Dorking, by 1 June, 1960.

DISTRICT SENIOR COMMERCIAL ASSISTANT (SALES)

WORTHING DISTRICT

Salary: £980/£1,055 per annum maximum on N.J.C. 6. Superannuable. The successful applicant will be responsible for sales promotion and publicity, and the co-ordination of the four showrooms in the district. His duties will also include the control of showroom stock.

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Applications, quoting ET and naming two referees, to District Manager, Seeboard, 56 Chapel Rd, Worthing, by 1 June, 1960.

GEORGE WRAY,
Secretary.
(P 888)

AN ASSISTANT ELECTRICAL ENGINEER is required by consultants engaged on several large and interesting schemes. Applicants preferably O.N.C. standard and with some practical or installation experience. Please submit details and salary required to: Donald Rudd and Partners, 3/5 Rickmansworth Rd, Watford, Herts. (P 899)

PERSONAL ASSISTANT TO MANAGING DIRECTOR

Outstanding Technical and Commercial ability are essential for this important post as well as practical experience and knowledge of motor control and low-voltage switchgear. Applicants must be qualified and keen to handle and co-ordinate all types of low-voltage switchgear schemes and contracts. Initiative, drive and organising personality is considered of particular importance. This is a worth-while opportunity for the right man.

Applications in strictest confidence to:

The Managing Director,
ELECTRO MECHANICAL MANUFACTURING CO. LTD.,
Marlborough St,
SCARBOROUGH

(P 843)

ALUMINIUM LABORATORIES LTD. (The Research and Technical Organisation of the International ALCAN Group of Companies) require an EXPERIENCED GRADUATE ENGINEER to undertake advanced design and development work on electrical machines. Pension and Life Assurance Scheme in operation. Apply to: Personnel Officer, Southam Rd, Banbury, Oxon. (P 864)

ELECTRICAL DRAUGHTSMEN

Draughtsmen having experience of circuit design of Control Systems are required to assist in the design of Temperature Control Panels. Some experience of sheet metal fabrication is also desirable.

Apply, giving details of experience, to the Personnel Manager,

THE RHEOSTATIC CO. LTD.
SLOUGH, BUCKS

(P 863)

A LARGE Steelworks in the United Kingdom is desirous of appointing a JUNIOR ELECTRICAL ENGINEER. This post offers excellent opportunities for promotion to a keen, energetic Engineer with a degree or equivalent qualifications. Age preferably under 25. Contributory pension and Free Life Assurance Scheme. Please send full details of age, qualifications, experience and salary level expected to Box No. 7861, Electrical Times. (P 868)

SENIOR DRAUGHTSMAN

Required by London Manufacturers, to assist in the design of Electrical Appliances. Applicants should have H.N.C. or equivalent and be experienced in the design of F.H.P. Motors. Please write, giving full details of qualifications and experience. All replies will be treated in strictest confidence. Applications should be addressed to the Managing Director, Box Z.S., 423, Deacons Advertising, 36 Leadenhall St, E.C.3. (P 865)

ELECTRICAL ENGINEER required to take charge of estimating department of large London electrical contractors. Please reply, giving full details, to Box No. 7857, Electrical Times. (P 849)

G.E.C.

SENIOR TRANSFORMER DESIGNERS

The General Electric Co. Ltd. has vacancies for Engineers experienced in the design of all classes of power transformers, including distribution transformers, rectifier transformers and high voltage power transformers up to the largest types.

Applicants should possess a degree in Electrical Engineering or at least Higher National Certificate with a minimum of five years' experience in design work.

The Company operates contributory sick and superannuation funds and assistance will be given with removal expenses.

Please apply in writing, stating qualifications and experience, to the:

Staff Manager,
THE GENERAL ELECTRIC CO. LTD.,
Witton,
BIRMINGHAM, 6

(P 902)

SALES ENGINEERS
HEAVY ELECTRICAL PLANT AND RECTIFIERS
'ENGLISH ELECTRIC'
STAFFORD

Applications are invited from Electrical Engineers interested in sales work associated with the supply of heavy electrical machines, transformers, rectifiers and their associated control equipment to heavy industry.

The posts are located in technical offices at our Stafford Works dealing with customer liaison, involving correspondence and personal contact as well as the compilation of tenders and estimates.

These openings offer an opportunity to gain valuable experience of up-to-date techniques in the field of heavy industrial applications as well as offering a secure and promising career in a stable industry.

Applicants should possess H.N.C. (E).
Assistance with accommodation will be discussed at interview.

Membership of the Staff Pension Scheme and eligibility for three weeks' holiday follow a qualifying period of service.

If you would like to visit Stafford to discuss these openings, please write giving full details to Dept. C.P.S., Marconi Hse, 336/7 Strand, London W.C.2, quoting reference ET 1297J.

(P 898)

ELECTRICAL DESIGN ENGINEER required to work with minimum supervision on interesting power and lighting schemes for major building projects. H.N.C. level of ability required. Apply in writing giving full details of age, experience and salary required to: Norman and Dawbarn, Architects and Consulting Engineers, 7 Portland Pl, London W.1. (P 861)

ELECTRICAL ENGINEER

An electrical engineer with H.N.C. is required for varied and interesting work in the Engineering Department of an organisation employing 1,200 people in South West Essex. Commencing salary from £750 p.a., according to age and experience. Send details of education and career to Box No. 7865, Electrical Times.

(P 901)

JUNIOR ELECTRICAL ENGINEER required to assist in the development and laboratory testing of Induction Watthour Meters and Associated Test Equipment. Minimum educational requirement H.N.C. (Electrical). Write giving full details of experience to the Personnel Manager, Sangamo Weston Ltd., Cambridge Rd, Enfield, Middx. (P 844)

TRANSFORMER AND POWER CAPACITOR ENGINEERS wanted for sales and contracts office. Preference given to candidates with H.N.C. or studying for this. Apply, Sales Director, Bryce Electric Construction Co. Ltd., Kelvin Wks, Hackbridge, Surrey. (P 846)

ELECTRICAL SUPERVISOR

An electrical supervisor with contracting experience is required to take control of specialised contracts in connection with electrical installation work in buildings.

This is a staff appointment and will suit a man who is keen to progress in a new department being developed within the Q-Floor division of the Company.

The job entails supervision of contracts from inception to completion, control of men and contract finance. The successful applicant will be based on Ellesmere Port, but will be involved in extensive travelling throughout the United Kingdom.

Reply in confidence stating age, experience and qualifications, if any, to Q-Floor Manager, Robertson Thain Ltd., Ellesmere Port, Wirral.

(P 896)

ELECTRICAL ENGINEER

Age under 35, with degree or equivalent professional qualification and with some experience in Mechanical Engineering, is required for appointment with Consulting Civil Engineers. The successful applicant will be concerned with the design and detailing of the electrical and some mechanical installations associated with docks, harbours, hydro-electric and irrigation schemes and associated buildings. The appointment offers considerable scope and responsibility to an electrical engineer with a particular interest in the planning and construction of large civil engineering works. Apply, with full particulars of qualifications and experience, to: Box No. 7863, Electrical Times. (P 900)

CONSULTING Engineers have vacancy for an ASSISTANT ELECTRICAL ENGINEER, preferably Grad. I.E.E., for work of wide variety on power plant, distribution and factory installations, including inspections of works, supervision on site and office work. Non-contributory pension scheme. Apply in writing with brief details, including present salary, to Messrs Mackness and Shipley, Abbey Orchard St, London S.W.1. (P 860)

TRANSFORMER AND POWER CAPACITOR ENGINEERS

wanted for Sales and Contracts office. Preference given to candidates with H.N.C. or studying for this. Apply Sales Director, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Surrey. (P 846)

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INDEX TO ADVERTISERS

Aircraft-Marine Products (Gt. Britain) Ltd. 25
Allen West & Co. Ltd. 13
Aluminium Wire & Cable Co. Ltd. ... 15
Ashley Accessories Ltd. 23
Associated Electrical Industries Ltd. (Cables Division) ... ... Cover (i)
Associated Electrical Industries Ltd. (Heavy Plant Division) 2
Associated Electrical Industries Ltd. (Instrumentation Division) 33
Associated Electrical Industries Ltd. (Motor and Control Gear Division) 63
Atlas Lighting Ltd. 34, 35, 73
Avo Ltd. 14

Backer Electric Co. Ltd. 30
Bayliss, Jones & Bayliss Ltd. 50
Belling & Co. Ltd. 6
Benjamin Electric Ltd. 67
B.I.P. Chemicals Ltd. 12
Brookhirst Igranic Ltd. 29
Brook Motors Ltd. 40
Brush Electrical Engineering Co. Ltd. 24

Cable Supports Ltd. 64
Central Electricity Generating Board 20
Channel Conduits Ltd. 45
Contactor Switchgear Ltd. 70
Critchley Bros. Ltd. 8
Crompton Parkinson Ltd. 38

East London Mica Works 66
Electrolube Ltd. 40
English Electric Co. Ltd. 41
Erskine, Heap & Co. Ltd. 18

Ferranti Ltd. 37

Geipel, Wm., Ltd. 72
General Electric Co. Ltd. 9
Gent & Co. Ltd. 60

Hackbridge Cable Co. Ltd. ... Cover (ii)
Hackbridge & Hewittic Electric Co. Ltd. 49
Harvey, G. A., & Co. (London) Ltd. ... 42
Hawker Siddeley Group 36
Hick Hargreaves & Co. Ltd. ... Cover (iv)

Imperial Aluminium Co. Ltd. 7
International Synthetic Rubber Co. Ltd. 65

Johnson & Phillips Ltd. 32

Kempston Electrical Co. Ltd. 70
Kitson's Insulations Ltd. 30

Laurence, Scott & Electromotors Ltd. 1
Lock, A. M., & Co. Ltd. 70
Low, Duncan, Ltd. 45
Lowe & Fletcher Ltd. 61
Lyons, Claude Ltd. 72

Marryat & Place Ltd. 30
Martindale Electric Co. Ltd. 70
Mercedes-Benz (Gt. Britain) Ltd. ... 5
Metalastik Ltd. 48
Metway Electrical Industries Ltd. 61, 72
Midland Electric Manufacturing Co. Ltd. 44
M.K. Electric Ltd. 59

Nalder Bros. & Thompson Ltd. ... 62

Otter Controls Ltd. 40

Pitman, Sir Isaac, & Sons Ltd. 62
Press, Wm., & Son Ltd. 31

Reyrolle, A., & Co. Ltd. 69
Rotunda Ltd. 68
Rowlands Electrical Accessories Ltd. ... 64

Salford Electrical Instruments Ltd. ... 3
Sanders, Wm., & Co. (Wednesbury) Ltd. 4
Shell-Mex & B.P. Ltd. 16, 17
Siemens-Schuckert (Gt. Britain) Ltd. ... 8
Simplex Electric Co. Ltd. ... 10, 11
Sims, F. D., Ltd. 62
Smith, Fredk., & Co. 71
Square D. Ltd. 26, 27
Standard Telephones & Cables Ltd. ... 39
Statter, J. G., & Co. Ltd. 72
Steatite & Porcelain Products Ltd. ... 28

Termination Equipment Co. Ltd. ... 45
Texas Instruments Ltd. ... ... Cover (iii)
Thomas, Richard, & Baldwins Ltd. ... 47
Trunduct Ltd. 19

Wandleside Cable Works Ltd. ... 46
Westinghouse Brake & Signal Co. Ltd. 74
Wootton & Co. Ltd. 68

Zenith Electric Co. Ltd. 66

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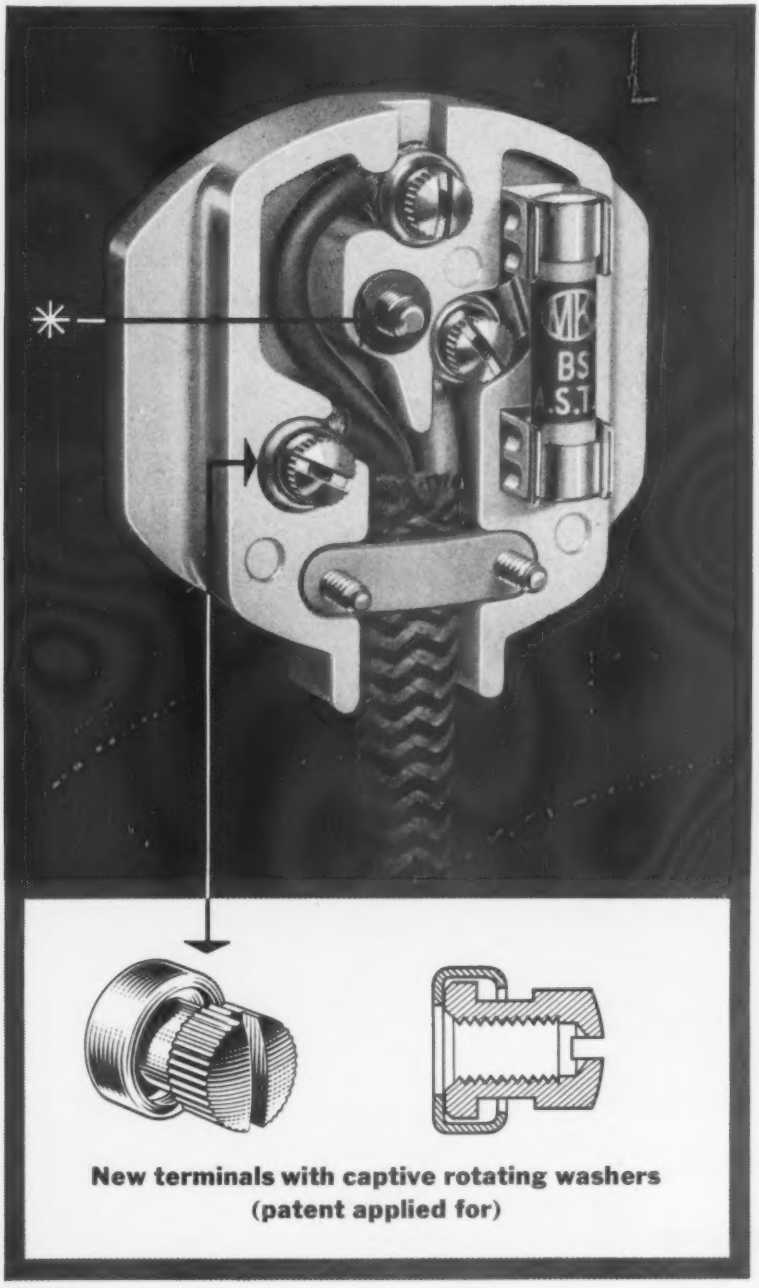

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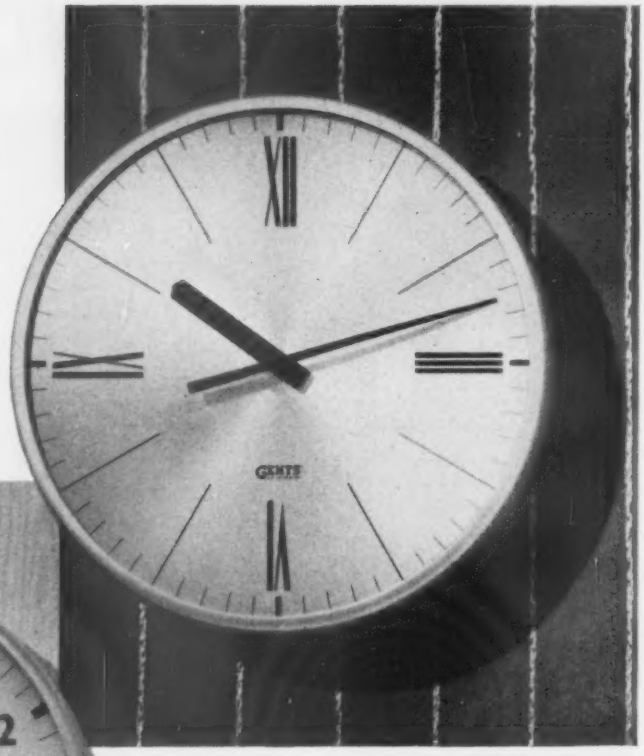

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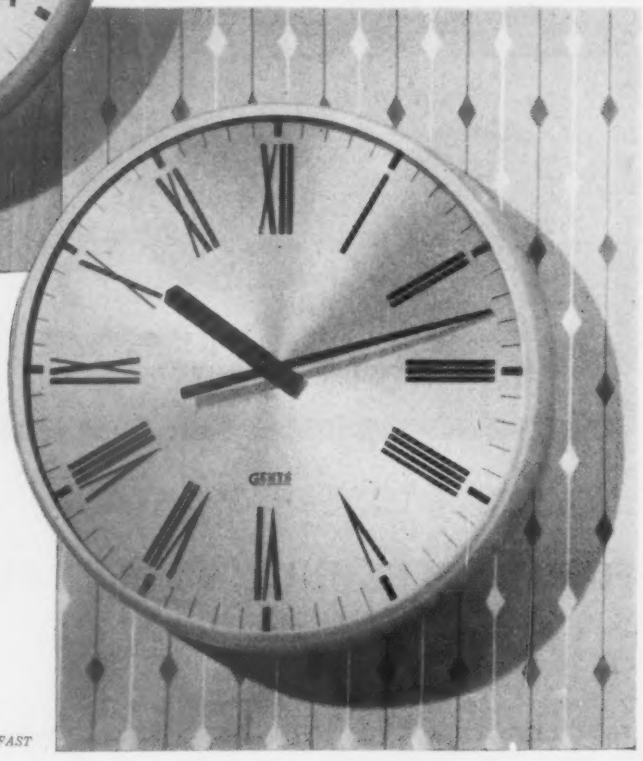

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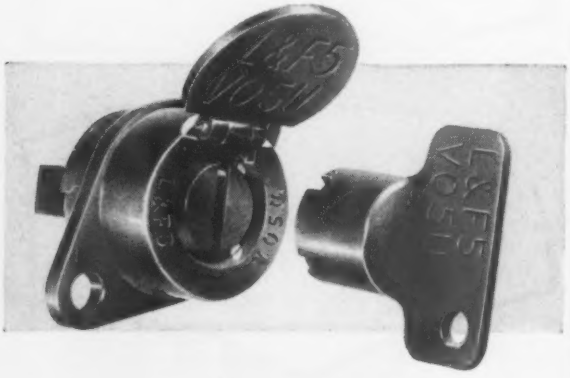

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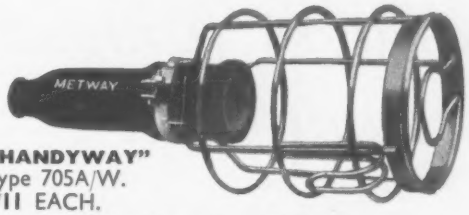

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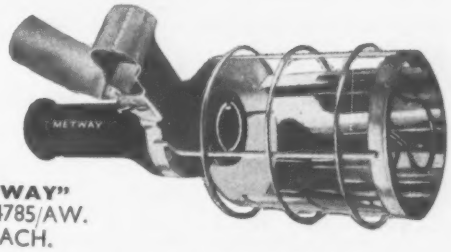

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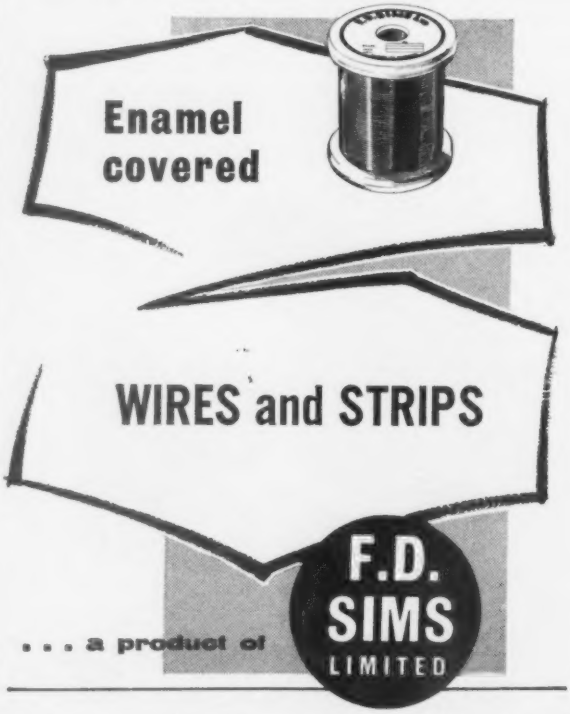

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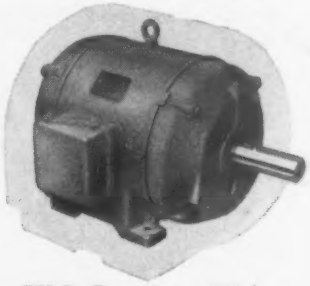

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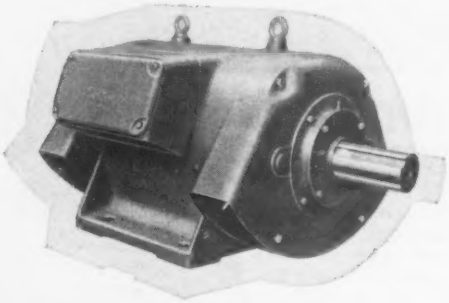

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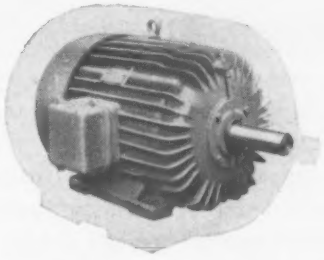

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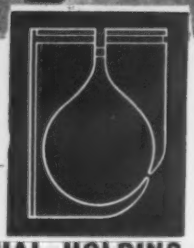

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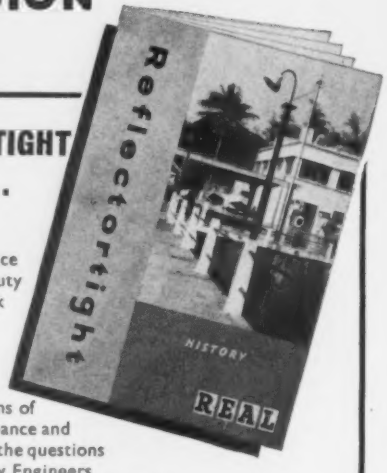

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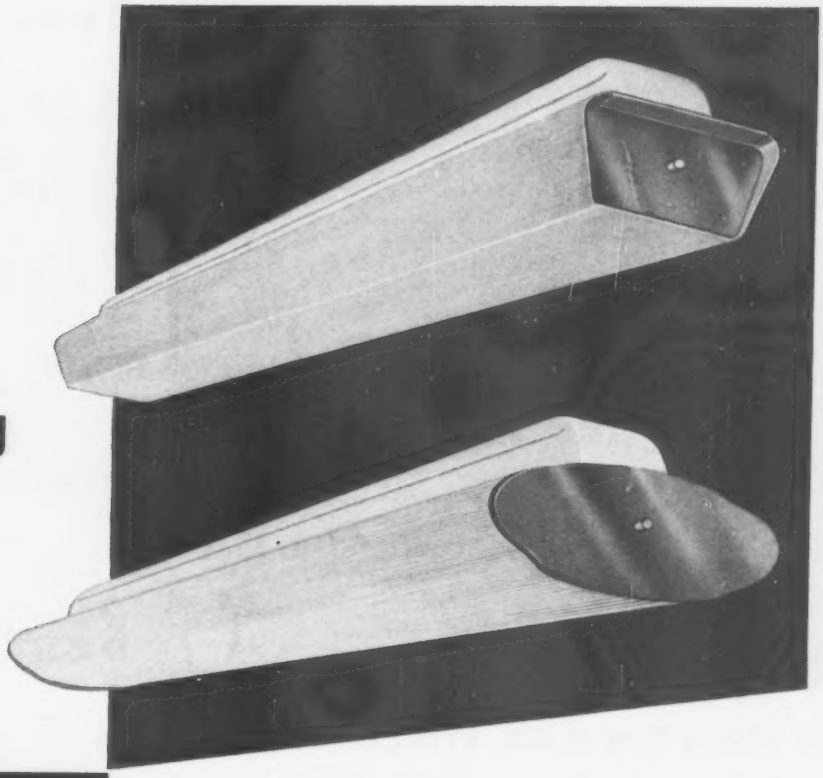

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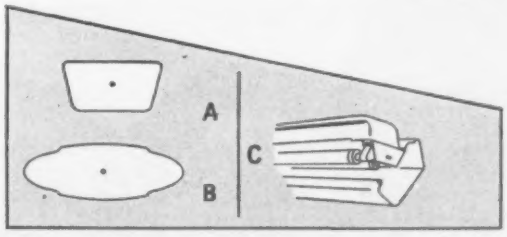

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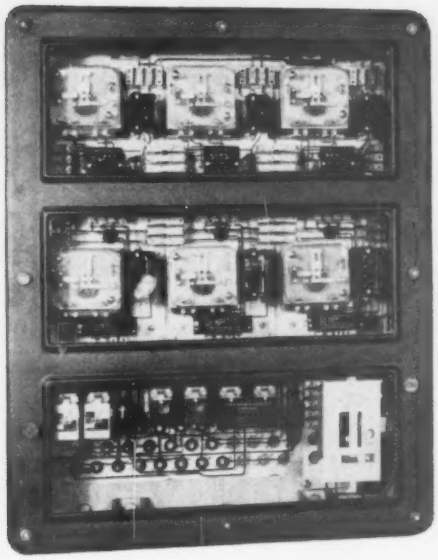

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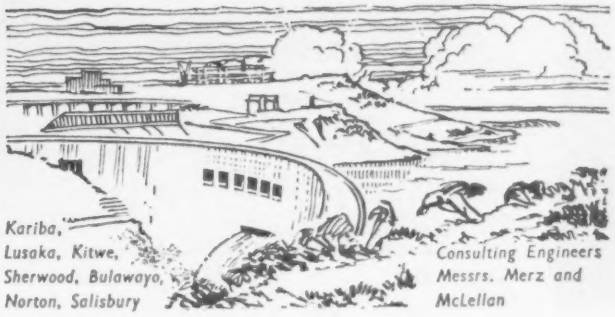

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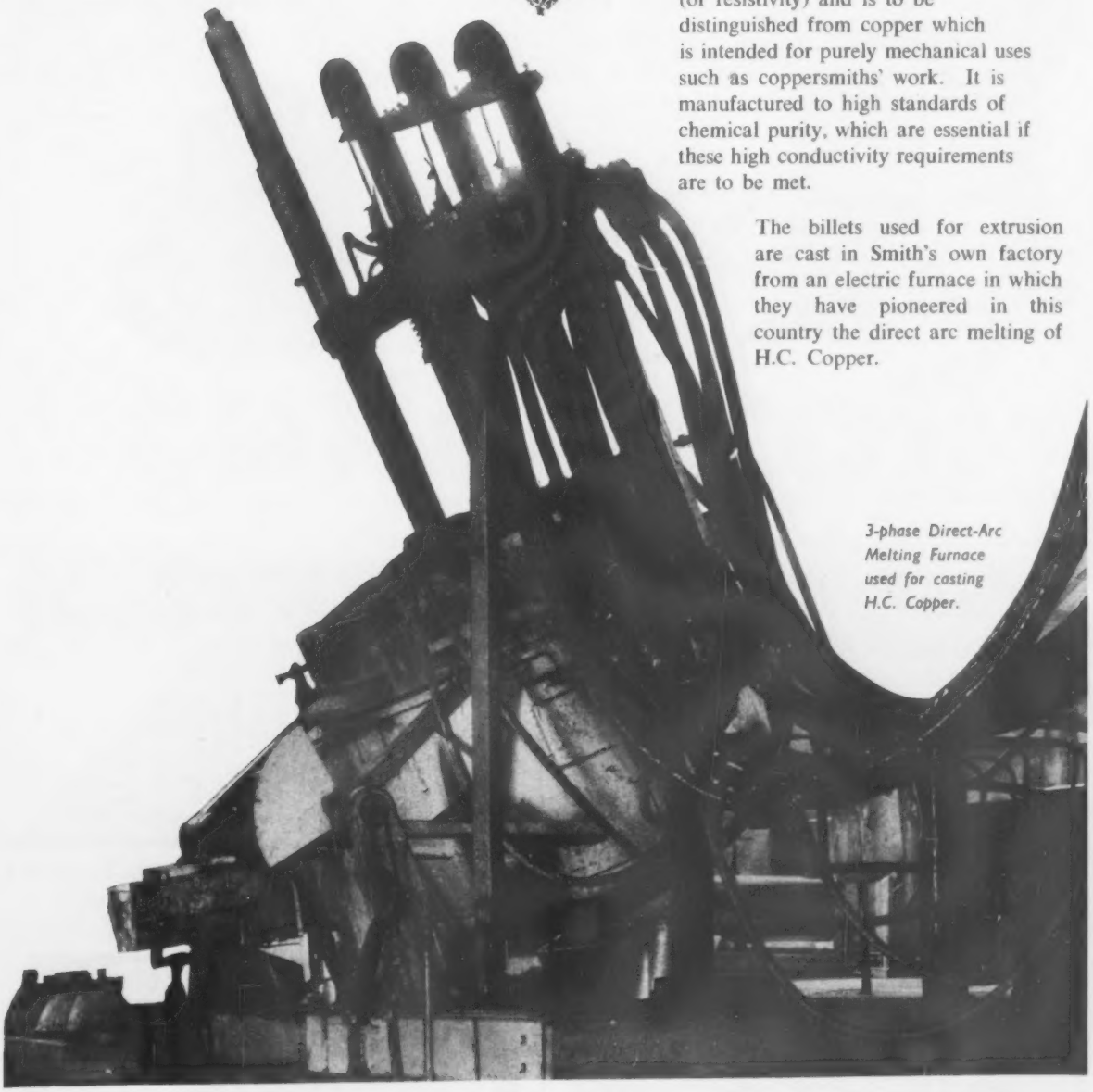

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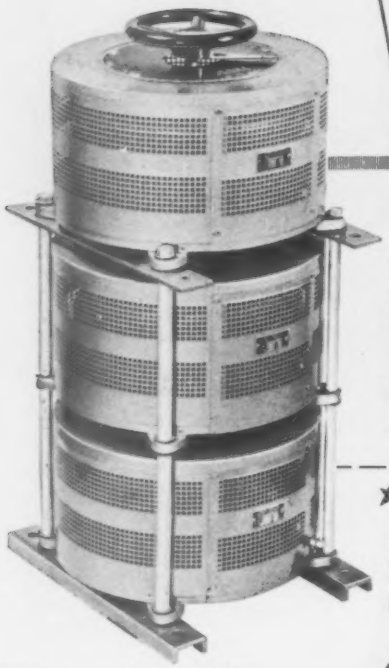

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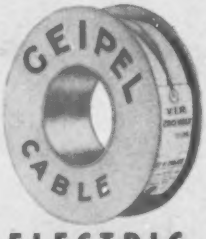

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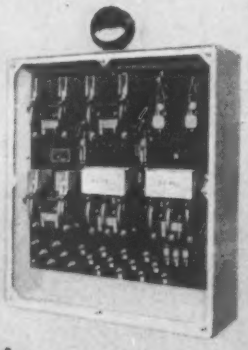

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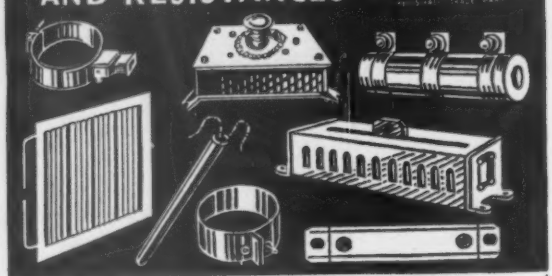

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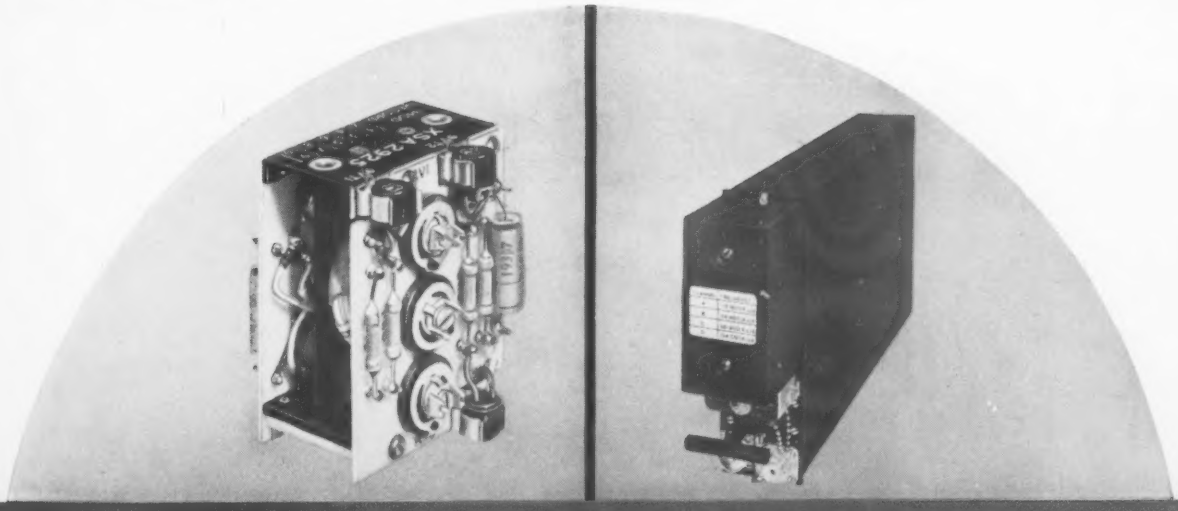

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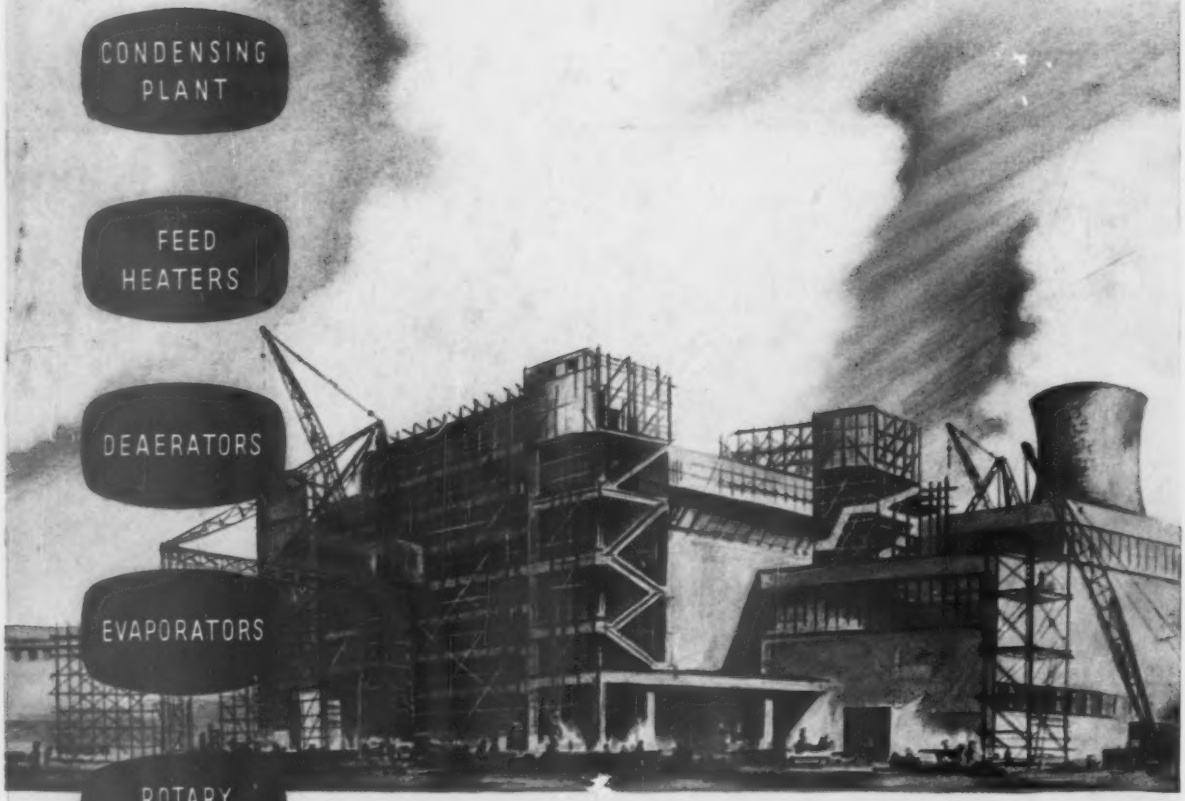

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